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Pr11034 - Specification for Trunk Water Mains Design and Construction

Addendum to SEQ Service Providers Edition of the WSAA Water Supply Code V1.3 August 2019

Read this Code in conjunction with SEQ Water Supply Code

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Document Sponsor	Infrastructure Standards and Products Approval Committee
Document Owner	Head of Asset Management
Subject Matter Expert	Network Engineering Manager
References	Refer to Section 3 of this document

Version Review

Revision	Reviewed by	Approved by	Date approved	Revision type/summary
1.0	A White Y Skinner	I Bierne	11/11/2022	Original. Note section numbering aligns with SEQCode so may appear out of sequence in this document.
2.0	L. Bryson	N/A	N/A	28/11 Minor admin amendment to replace Department of Envionment and Heritage Protection (DEHP) with Department of Environment and Science (DES) as per current structure.
3.0	L. Bryson	N/A	N/A	02/02 Minor amend to update naming convention for CWPM12 to Pr11074 as per CIPM doc framework
4.0	Y Skinner	J Wain A/Head of Asset Managment	28/08/2023	Updated PE Welding & Joint testing requirements by refering to requirements in Pr9904 - Specification for Pressure Pipe Construction
5.0	J.Munro Document Control Officer	N/A	N/A	27/09/2023 Minor admin amendment to replace obsolete reference Pr8874 with Pr11211
6.0	L. Bryson	N/A	N/A	04/10/2023 Minor admin amendment to fix page numbering and typo in TWM – C
7.0	J.Munro Document Control Officer	N/A	N/A	13/11/2023 Minor amendment to reference correct policy.

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Contents

INTRODUCTION

A. Purpose

This Trunk Water Main Design and Construction Code (TWM Code) is an Unitywater addendum to the SEQ Water Supply Design and Construction Code (SEQ Water Code). The purpose of this specification to assist engineering consultants prepare design documentation for proposed trunk water mains to be owned and operated by Unitywater.

The purpose of this specification is to define Unitywater's requirements the design, construction, commissioning, and handover for any new Trunk Water Mains to be located within Unitywater's water network.

This document must be read in conjunction with the current version of the SEQ Water Code [which at the time of writing this document is the SEQ Service Providers Edition of the WSAA Water Supply Code – Version 1.3 (August 2019)]. This Specification shall also be read in conjunction with relevant project drawings (where applicable), project specification and supplementary specifications.

For information on abbreviations, acronyms and definitions used within this document, please refer to the current SEQ Water Code.

Unitywater will update this document as Unitywater's technical requirements for trunk water mains evolve over time, or until such time that the scope of the SEQ Water Code is broadened to include TWM requirements.

Unitywater reserves the right to specify or approve other TWM design and/or construction requirements for projects and/or developments. Before commencement of any construction, Unitywater's approval shall be obtained for any design and/or installation that does not comply with this document.

Background

Currently the SEQ Water Code provides design and construction requirements for South-East Queensland Service Provider (SEQ-SP) reticulation mains up to and including 300 millimetres (mm) nominal bore in size, and only guidance for SEQ-SP trunk water mains.

The intent of this Unitywater TWM Code is to provide greater clarity regarding Unitywater requirements for the design and construction trunk water mains built on behalf of (or donated to) Unitywater. For the purposes of this TWM Code, trunk water mains are those mains with a nominal bore size greater than 300mm.

B. Scope

This TWM Code is only applicable for the design and construction of trunk water mains to be owned and operated by Unitywater. For information regarding design and construction requirements for trunk water mains (to be) owned and operated by other Service Providers (e.g. City of Gold Coast, Logan City Council, Redland City Council, Urban Utilities, Seqwater, etc.) please contact them directly.

Please note, Seqwater has separate requirements for work near its TWM Network. These requirements can be obtained by contacting consents@seqwater.com.au – or alternatively telephone Seqwater on (FREECALL) 1800 771 497 for further information.

The Project Proponent is responsible for obtaining all third-party approvals relating to the design and construction of Unitywater TWM infrastructure. All third-party approvals shall be obtained by the Project Proponent and submitted to Unitywater during the TWM design phase. It is the Project Proponent's responsibility to prepare the design in accordance with the requirements of all relevant stakeholders.

Please note, any endorsement of the design documentation by Unitywater does not infer that any other agency has endorsed/accepted the design.

The Project Proponent (and their consultants/agents) are responsible for ensuring that all works are executed in accordance with Unitywater requirements, as well as sound engineering principles and practices.

All designs shall be prepared and certified by a Registered Professional Engineer of Queensland (RPEQ) considering all relevant construction, operational, maintenance, repair and demolition aspects of the proposed works. As-constructed works shall be certified by a Registered Professional Engineer of Queensland (RPEQ).

Conditions of Supply of the Unitywater TWM Code

The TWM Code is supplied subject to the following understandings and conditions:

- The TWM Code is copyright and apart from any use as permitted under the *Copyright Act 1968*, no parts of the documents may be sold, reproduced, stored in a retrieval system or transmitted in any form or by any means without the prior permission in writing of Unitywater.
- This TWM Code is intended for use in connection with Unitywater related projects only.
- Unitywater does not warrant the applicability of the TWM Code and SEQ Water Supply & Sewerage Design & Construction Code to climates, topography, soil types, water characteristics and other local conditions and factors that may be encountered outside Unitywater area of operation.
- The holder of the TWM Code acknowledges that they may contain errors and/or omissions.
- Unitywater accepts no responsibility for the incorrect application of the TWM Code by the holder or any other party.

Any details not currently denoted in the TWM Code shall be referred to Unitywater.

C. References

Document Hierarchy

If there is a discrepancy between this document and the SEQ Water Supply & Sewerage Design Criteria (SEQ WS&S Design Criteria), the SEQ WS&S Design Criteria shall take precedence.

If there is a discrepancy between the TWM Code and the SEQ Service Providers Edition of the Water Supply Code (SEQ Water Code), the TWM Code shall take precedence for all matters relating to TWM.

Where the underlying SEQ Water Code requirements are not shown in this document, the SEQ Water Code requirements shall apply.

If there is a discrepancy between the TWM Code text and the TWM Code Appendices (including details shown in the Example Drawings, the TWM Code text shall take precedence.

Where a discrepancy exists between the TWM Code and any other relevant document (including Unitywater documents/specifications/requirements), please consult with Unitywater to seek advice regarding which requirement takes precedence.

Feedback and Information

Please direct all comments and suggestions regarding this document by email to: seqcode@unitywater.com.

For further information on the South East Queensland Water Supply and Sewerage Design Construction Code (SEQ Code), or to provide comments and suggestions, visit www.seqcode.com.au.

UNITYWATER TRUNK WATER MAIN DESIGN AND CONSTRUCTION CODE

ADDENDUM TO SEQ SERVICE PROVIDERS EDITION OF THE WSAA WATER SUPPLY CODE OF AUSTRALIA V1.3 (AUG 2019)

USING THE TWM CODE

- This TWM Code shall be read in conjunction with the SEQ Water Supply Code text.
- Unitywater TWM requirements consist of the requirements within the TWM Code, as well as the SEQ Water Supply Code text.
  NOTE: the entire SEQ Water Supply Code text has not been duplicated within this document
- Where an SEQ Water Supply Code clause is not detailed within the TWM Code, refer back to the SEQ Water Supply Code for the requirements.

TWM CODE CLAUSE NUMBERING

- **Not all clauses from the SEQ Water Supply Code are shown in this TWM Code. As a result, the clause numbering within the TWM Code is not always sequential – this is not an error**.
- Generally, only Clauses which contain amendments to the SEQ Water Supply Code text, specifically for the design and construction of Unitywater trunk water mains, are shown in this document.
- Clause numbering and clause headings used in the TWM Code correspond with the same clause numbering & headings used in the SEQ Water Supply Code text.

TMW CODE TEXT COLOURING

Black Text: SEQ Service Providers Edition of the WSAA Water Supply Code

Green Text: Amendments to the SEQ Service Providers Edition of the WSAA Water Supply Code text, specifically relating to the design and construction of Unitywater trunk water mains.

PART 1: PLANNING AND DESIGN

1. General

1.1 Scope

The Reader should be aware that:

(a) Specific design parameters relevant to this document are contained within the SEQ WS&S Design Criteria

(b) Where there is conflict between this Code and the SEQ WS&S Design Criteria, the latter shall take precedence.

1.2 Planning and design

1.2.1 Scope and requirements

The nominated requirements of the SEQ-SPs planners and designers will be in accordance with the SEQ Water Supply and Sewerage Design Criteria and the Queensland Planning Guidelines for Water Supply and Sewerage Schemes. The SEQ Water Supply and Sewerage Design Criteria takes precedence over all other planning advice.

1.2.2 Concept Plan Format

The concept plan shall:

d) identify special requirements of Unitywater including, but not limited to:
   (i) provision for future expansion of the system and/or required augmentation of the existing system; and
   (ii) critical infrastructure protection (Refer 1.2.4 Critical infrastructure protection), and
   (iii) Layout of mains together with the development layout, and
   (iv) Key to network analysis e.g. node points, elevation, demand, and
   (v) Size and type of mains indicated graphically and distinguished by colour and/or line type, and
   (vi) Design parameters – number of lots, number of ET, design flows, and
   (vii) Legend of Domain types (residential, Industrial etc.), and
   (viii) Supply points and pressure or Hydraulic Grade Line (HGL) as supplied by SEQ-SPs, and
   (ix) Location of pumps, pressure reducing valves and reservoir Top Water Level (TWL) and volume and a listing of proposed easements and land to be dedicated to SEQ-SPs, and
   (x) Limit of water district serviced by the mains, and
   (xi) Proposed contours for the entire development at a minimum of 5 m intervals, and
   (xii) Connections to adjoining and/or future developments as directed by SEQ-SPs, and
   (xiii) Valve layout including standard cross connections where specified by SEQ-SPs for Class A+ non-drinking water systems where a non-drinking water supply is not immediately available.

(xiv) Consideration of existing and proposed infrastructure (e.g. roads, road improvements, proximity of drainage infrastructure, etc.) when determining location of appurtenances, connections and scour outlets.

The plan shall also consider and address as necessary:

(B) Site Access, Tenure, Environment and Environment as well as land use planning requirements. *(Refer to Unitywater Documents Pr8856 - Project Control Environmental Procedure and Pr11074 - CIPM - Site Assessment Procedure).*

1.2.3 Critical Infrastructure Protection

1.2.3.1 Asset Categorisation

Concept plans shall address, as necessary, asset categorisation that relates to the consequences of loss of asset function – refer to Unitywater. Asset categorisation shall be determined by the relevant State and Federal rating system for critical infrastructure in consultation with the Unitywater *(Refer to Unitywater's Pr10436 - Asset Management System Manual)*.

1.2.4 Detailed Design

1.2.4.1 Designer's needs and responsibilities

The design of the works shall be carried out under the direction of and certified by a Registered Professional Engineer of Queensland (RPEQ) as defined by the Professionals Engineers Act (Qld).

The Designer shall obtain the written approval from Unitywater for any variations to the requirements of the latest TMW Code, as amended by Unitywater prior to the submission of the final design.

1.2.4.2 Requirements to be addressed

The Designer shall use Unitywater Template F8586 - Design Report for the proposed TWM works, which shall address, inter alia, the following:

(a) Unitywater's policies, customer charters and contracts;
(b) Unitywater's standards not otherwise contained or referenced by this Code;
(c) hydraulic adequacy of the system;
(d) ability of the water system to maintain acceptable water quality;
(e) critical infrastructure protection measures;
(f) structural adequacy of system components for the design life;
(g) ease of operation and maintenance of pipeline system components;
(h) OH&S requirements including requirements under the Queensland *WH&S Act 2011*;
(i) environmental requirements including environmental and community impact of the works;
(j) easement requirements;
(k) minimisation of life cycle costs;
(l) resistance of each component to internal and external corrosion or degradation for the design life;

(m) system flexibility and robustness to functional changes;

(n) constructability and methods of construction;

(o) physically confirmed locations and alignments of Unitywater and other Utilities (or Service Providers) infrastructure which may be impacted by the proposed works in accordance with *AS 5488.1 Classification of subsurface utility information Part 1: Subsurface utility information* Quality Level A requirements;

(p) scope of work, including all water supply connections, disconnections and diversions to enable the proposed infrastructure to be successfully constructed. (Prior consultation with Unitywater is required to determine whether there are any existing network limitations/constraints that will influence how, when and where network connection, disconnection, augmentation and/or diversion arrangements are to be designed);

(q) all work associated with the potholing and survey of services shall ensure that service locations and alignments are accurately reflected in the design drawings;

(r) the proposed water infrastructure terminates at a location and in a way that facilitates ease of future connection to the network, whilst minimising disruption to the community and the need to obtain private landowner's consent;

(s) factors that will impact the design of the infrastructure – including water chemistry of source water, ground conditions (e.g. acid sulphate soils, areas with known mining subsidence, ground containing hydrocarbons etc.);

(t) impacts to Stakeholders, customers, community, Local Authority, Road Authorities and service providers (e.g. Rail Authority);

(u) extents and location of mechanical protection (i.e. pipe enveloper or concrete encasement) on existing trunk water main;

(v) extents, location and status of existing water network pipeline anti-corrosion measures (e.g. cathodic protection systems); and

(w) Existing water network upsizing / augmentation proposed works.

In addressing the above requirements, the Basis of Design Report shall be developed in accordance with relevant Queensland legislation and regulations, Codes of Practice, Australian Standards and Unitywater technical standards.

1.2.4.3 Design Outputs

Design Drawings and Specifications for construction purposes shall clearly address the issues of a particular project. The design output shall include, but not be limited to:

(a) Design drawings showing, as appropriate, location of pipelines, valves, pump stations, reservoirs and buildings, PRVs, cross connections to other Service Providers (e.g. Seqwater) pipe materials, size, pressure class, jointing methods and corrosion protection measures.

(b) Detailed construction drawings showing the location of all relevant obstructions, as well as all existing services within and around the vicinity of the works areas, that have been accurately located using non-destructive methods (e.g. pot-holing).

(c) Specifications for products, materials, site investigation, excavation / trench details and other technical matters.

(d) Documentation of design assumptions, constraints and issues relevant to the design and not otherwise noted in the Concept Plan or Design Drawings or Specifications.

(e) Any variations to this TWM Code, and the reason for the variation, shall be highlighted in a boxed note on the design drawings.

(f) Basis of Design Report.

(g) Safety in Design Report.

(h) Detailed drawings and relevant specifications (including structural, electrical, mechanical, control system, process logic, civil and hydraulic design). *Refer to* ***Appendix TWM-C*** *for list of relevant Unitywater Documents*;

(i) Design Report *F8586* (inclusive of calculations, geotechnical report, hydraulic analysis including transient analysis, water quality (at least L'Angelier Index to check corrosivity of the water being conveyed if a cement-lined pipe is proposed), design criteria in relation to geotechnical and imposed load assumptions, survey and electrical investigations, environmental report and cultural heritage report;

(j) Quality Management Plan including inspection and test plan.

Refer to ***Appendix TWM-A*** *for relevant Example Project Drawings which are provided as guidance only to show typical minimum requirements.*

In addition, refer to ***Appendix TWM-B*** *for a list of relevant SEQ Water Supply Standard Drawings that may also be used for guidance only. NOTE: These drawings are not intended for use in TWM designs.* The Example Project Drawing and SEQ Code Standard Drawings are not suitable for construction without further engineering design.

1.2.5 Design Life

Asset Design Lives shall be in accordance with **Table 1.2** below:

Table 1.2 - Asset Design Lives

ASSET DESCRIPTION	DESIGN LIFE
Trunk Water Mains (and all appurtenances including valve pits/chambers)	100 years
Pumps	20 years
Valves	30 years
SCADA	15 years
Buildings / Structures	Refer to Unitywater for requirements
Reservoirs	100 years

1.2.6 Instrumentation and Control Systems

All designs incorporating monitoring and control equipment shall comply with Unitywater requirements. *Refer to* ***Appendix TWM-C*** *for list of relevant* Unitywater *Documents.*

2. System Planning

2.1. Demands

2.1.1 Peak Demands

2.1.1.1 General

The SEQ Water Supply and Sewerage Design Criteria define the demands to be used and their various Peaking Factors.

2.2. System Hydraulics

2.2.1 Network Analysis

Unitywater requires a network analysis. Specific advice will be given at the Concept Plan stage where a network analysis is not required.

2.2.2 Operating Pressures

2.2.2.1 Maximum allowable service pressure

Unitywater will provide specific advice on the need for a PRV at the Concept Plan stage.

2.2.2.2 Minimum Service Pressure

Unitywater requires a network analysis. Specific advice will be given at the Concept Plan stage where a network analysis is not required.

Refer to SEQ WS&S Design Criteria for Drinking Water Single Supply Service Pressure Limits

2.3. Water Quality

2.3.1 General

Network configuration planning shall include consideration of the following aspects to manage water quality:

(a) Black flow prevention where appropriate

(b) Water age

(c) Disinfection and disinfectant type

(d) Material of TWM and long terms impacts to water quality (pH increase etc) or impacts to TWM material

(e) Installation of sample taps or water quality monitoring devices

Water quality shall be considered across the whole lifecycle of the network, particularly for large and mid-sized new developments when water consumption/usage may be minimal during the early life of the assets. Interim staging or network interventions may be required until the population or water consumption increases. In consultation with Unitywater, designers should consider such factors as:

a) Sizing of the network to consider water quality aspects such as minimum diurnal velocities within the main & potential deposition of sediment. This may require pigging points, Y junctions or scours to be installed.

b) Water age in Unitywater's network to not exceed 10 days. This may require a mix of capital and operational to deliver a least lifecycle outcome in accordance with the requirements of Unitywater's Connections Policy and the SEQ Code.

c) Staging of reservoir capacity or different operating parameters for reservoirs.

d) Cross-connections to existing infrastructure.

2.4. Trenchless Techniques for Pipelaying

Trenchless techniques shall be evaluated for alignments:

(a) passing through:

(i) environmentally and culturally sensitive areas;

(ii) built-up or congested areas to minimise disruption and reinstatement; and

(iii) other areas, particularly where the location is not suitable for trenching e.g. crossings of railway and roads controlled by Qld Department of Transport & Main Roads, and

(b) where the impact of the works on existing pavements and trees can be reduced.

Refer to Unitywater Documents Pr9787 - Microtunnelling & Pipejacking Specification & Pr9788 - Horizontal Directional Drilling specification respectively.

2.5. Future System Expansion

The Planner shall make allowance for existing and future land use zonings and possible rates of development based on the Unitywater defined planning.

3. Hydraulic Design

3.1 Sizing

3.1.1 General

TWMs shall be sized in accordance with the SEQ WS&S Design Criteria so that Unitywater can comply with regulatory and/or customer contract/agreement requirements.

3.1.2 Sizing by Analysis

3.1.2.1 Head Losses

To facilitate economic designs, the design shall be conducted to achieve less than the following head losses, unless alternate heal loss rate limits are specified or approved by Unitywater:

(b) 3 m head/km for ≥ DN 200 (CIOD) or ≥ DN 250 (ISO)

Head loss shall be calculated using computer models or hydraulic formulas in consideration of the SEQ WS&S Design Criteria or where approved AS 2200. Unitywater may specify a preferred or mandated head loss calculation procedure.

Designers shall consider the impact of reduction in pressure to existing TWM infrastructure for any TWM extensions.

3.1.2.2 Hydraulic Roughness Values

Refer SEQ WS&S Design Criteria for the defined Pipe Friction calculation and hydraulic roughness values.

3.1.2.3 Flow Velocities

The design shall ensure that acceptable flow velocities are achieved within the supply network. Refer SEQ WS&S Design Criteria for the defined Flow velocity values.

3.2 Pressure Class of System Components

3.2.1 Gravity Systems

For gravity systems, the PN of pipes and fittings shall be not less than the design pressure and a minimum of PN16 for general Operational needs.

3.3 System Test Pressure

The system test pressure applied to each section of a TWM network shall be such that:

(b) At the lowest point in the test section, the test pressure shall be the greater of:

(i) 1.25 times the system design pressure;

(ii) 120 m head (*refer to SEQ Code Standard Drawing SEQ-WAT-1205-1*).

3.4 Pipeline Components Minimum Pressure Class

The minimum pressure class for trunk water pipe and fittings shall be Class 16.

In addition to the above, the pipe and fittings pressure class shall always be greater than the design pressure.

*Refer to **Table 4a** and the current SEQ Accepted Civil Infrastructure Products and Materials (IPAM) List for minimum pressure class pipe component requirements for Unitywater.*

4. Products and Material

4.1 General

Products for which inadequate performance or premature failure may jeopardise the meeting of *Unitywater* "Standards of Service" or the economic life of the TWM system require authorisation for use by *Unitywater* prior to incorporation into the works.

Materials accepted by SEQ-SPs for water mains are listed in the SEQ Water Supply and Sewerage Design and Construction Code Accepted Civil Infrastructure Products and Materials list. In addition, the following limitations apply:

(a) The SEQ Accepted Civil IPAM list is intended for use for reticulation infrastructure, and only guidance for trunk infrastructure. All pipes and fittings require Unitywater acceptance.
(b) Accepted pipe material for trunk water mains shall be in accordance with **Table 4a**.

Table 4a - ACCEPTABLE PIPE MATERIALS FOR TRUNK WATER

CHARACTERISTIC	TWM PIPE MATERIAL SUITABILITY		
	Mild Steel	**Ductile Iron**	**Polyethylene (PE100)**
Acceptable to Unitywater	Yes	Yes	Yes
Minimum Pipe Pressure Class:	PN16	PN35	PN16
Accepted Sizes:	OD406, 457, 508, 610, 762, 914, 1016 and 1290	DN375, 450, 500, 600 and DN750 *(ISO Sized DI pipes shall not be used where practicable, and requires prior written approval by Unitywater)*	DN355, 450, 560, 630, 800, 900
Accepted Internal Pipe Lining:	General Purpose Portland Cement Lining with Seal Coat	General Purpose Portland Cement Lining with Seal Coat	n/a
	Fusion Bonded Polyethylene lining	Factory applied Polyurethane lining	
Accepted External Pipe Coating	Fusion Bonded Polyethylene Coating	Zinc-Aluminium 400 g/m^2 with epoxy coating	n/a
Acceptable Installation Techniques	Open Trench	Open Trench	Open Trench*
			HDD
Acceptable Jointing where mechanical protection (i.e. pipe enveloper or concrete encasement) of TWM pipework is not required	RRJ	RRJ	Butt Welded
	Flanged	Flanged	Flanged
	Welded		E-F*
			Mechanical (Gripper)*
Acceptable Jointing where mechanical protection (i.e. pipe enveloper or concrete encasement) of TWM pipework is required	Welded joints	No joints allowed	Butt welded joints only

*Proposed jointing products and systems require prior written approval from Unitywater with the design to include, but not limited to, design calculations for fittings and system thrust restraint and design life compatibility between individual system components.

Any pipe materials that are not listed in **Table 4a** (above) are not accepted by Unitywater for trunk water mains.

Guidance on pipe material selection shall consider site and pipe protection characteristics, as summarised in **Table 4b**.

Table 4b – PIPE MATERIAL SELECTION CONSIDERATIONS FOR TRUNK WATER MAINS

SITE & PIPE PROTECTION CHARACTERISTICS	TWM PIPE MATERIAL SUITABILITY		
	Mild Steel	**Ductile Iron**	**Polyethylene (PE100)**
Pipework located within corrosive or acid sulphate soils	Preferably not (unless cathodic protection is considered)	Preferably not (Zinc-Aluminium Coated Pipes may be considered)	Yes
Pipework located in contaminated ground *(i.e. ground contaminated by organic compounds, such as hydrocarbons and chlorinated hydrocarbons)*	Yes – with welded joints	Preferably not	No
Pipework located in reactive soils (i.e. typically clay-type soils that swell when wet and shrink when dry)	Yes – with welded joints	Yes - RRJ	Yes – with welded joints
Pipework located in areas prone to mining subsidence and ground movement	Yes – RRJ or welded joints	Yes - RRJ	Yes
Pipework located near overhead power lines and transmission towers *(refer Cl 5.4.12)*	Preferably not (unless surge diverters or cathodic protection is installed)	Preferably not	Yes
Pipework conveying drinking water with corrosive water chemistry	Yes – provided pipe has cement lining or other accepted internal lining	Yes – provided pipe has cement lining or other accepted internal lining	Yes
Cathodic Protection (CP) Requirements	CP shall be considered where pipework: crosses creeks; is installed within corrosive / acid sulphate soils, is susceptible to	Unitywater does not typically install cathodic protection on DI mains	n/a

SITE & PIPE PROTECTION CHARACTERISTICS	TWM PIPE MATERIAL SUITABILITY		
	Mild Steel	Ductile Iron	Polyethylene (PE100)
	stray current corrosion		

Pipeline materials selection should be carefully considered to ensure adequate strength to enable the asset to behave in the manner for which it is designed for the duration of it specified service life without being uneconomical. Materials selection process shall consider the following factors: pressure rating, structural behaviour, operational regimes, environmental setting, installation methods and asset criticality.

The asset criticality assessment of the proposed installation shall be assessed in conjunction with Unitywater and shall consider as a minimum: operating pressures, risk profile, loss effect, network redundancy and operability.

Assets that have a consequence of failure of **High Significance** or **Most Significance** are considered critical assets.

E.g. A transfer supply main between major supply points (reservoirs), where failure could result in widespread supply outages for (>15hr but <25hrs), third-party damage and reputational damage would likely be considered as having an asset consequence of failure of 'High Significance'. As such, the material selection for such an asset may be a fully welded mild steel pipeline.

Refer to Unitywater Document Pr9306 - Unitywater's Risk Management Procedure.

4.2 Ductile Iron Systems

4.2.1 Product Specifications

DI pipe class shall be PN35. DI fittings shall be minimum PN16.

Ductile Iron Pipe (Cast Iron Outside Diameter – CIOD) shall be used unless otherwise agreed by Unitywater.

4.2.2 Flanged Joints

PN16 flange dimensions and associated bolting details shall be in accordance with Figure B5 of AS 4087.

Flanged joints (including screw-on flanges) shall not be subject to moment forces and shall not to be used underground unless special provision is made to either fully support the pipe or incorporate flexible joints.

4.2.3 Diametral Deflection

DI pipes are to be designed to limit diametral deflection of the pipe to 2% of the pipe diameter.

4.3 PE Pipeline Systems

PE pipes and fittings shall comply with AS/NZS 4129 and AS/NZS 4130 with minimum PN16 pressure rating. PE pipe equivalent sizes shall be as per Appendix B of the current version of the SEQ Water Code.

Where PE pipe material has been approved for use for at specific location, provision of critical spares shall be provided to Unitywater as part of the Works (i.e. nominal straight length of pipe + 2 approved mechanical couplings).

PE TWM systems shall be butt welded.

The use of electro-fusion or mechanical joints on PE trunk water mains (including at connection points) requires the prior written approval of Unitywater.

PE fittings (and associated PE welding box) shall be provided by a single supplier that preferably has an associated PE welding Quality and Assurance software application, so that all records relating to the PE welds are provided to Unitywater at no cost, and in accordance with the product manufacturers requirements.

Only full-face full-bore PE flanges with stainless steel (SS 316) backing rings shall be permitted for flange connections (including valve connections). *This is because PE stub flanges which are not full face may rotate due to relaxation of the PE stub flange material*.

PE Pipes are to be designed to limit the diametral deflection of the pipe to 4% of the pipe diameter.

PE welds and weld testing shall conform to the requirements of Pr9904 – Specification for Pressure Pipe Construction.

4.4 Steel Pipeline Systems

4.4.1 Sizes and Configurations

Steel pipe and fittings shall be minimum Grade 250, minimum yield strength 250 MPa and conform to the requirements of AS 1579.

Steel pipes and fittings shall be minimum PN16.

All steel pipes and fittings shall have a minimum wall thickness of 6 mm.

Steel pipes are to be designed to limit diametral deflection of the pipe diameter to prevent spalling of cement mortar lining.

- For welded MSCL pipe, diametral deflection shall be no more than 3%
- For RRJ MSCL pipe, diametral deflection shall be no more than 2%

4.4.2 Joints

Refer to SEQ Code Standard Drawings SEQ-WAT-1313-1, SEQ-WAT-1400-1, SEQ-WAT-1401-1, SEQ-WAT-1402-1, SEQ-WAT-1403-1 and SEQ-WAT-1405-1 for guidance regarding jointing of steel pipework.

4.4.3 Flanged Joints

Refer to SEQ Code Standard Drawings SEQ-WAT-1313-1, SEQ-WAT-1403-1, SEQ-WAT-1404-1 and SEQ-WAT-1405-1 for guidance regarding flanged joints.

4.4.4 Closing Joints

Provision is to be made for a collar closing joint where the TWM runs between two anchored points e.g. bends or valve pits. The construction procedure shall be to construct a bend and anchor block with one full pipe on each side and then lay the intermediate pipes. The closing pipe is cut to suit and collared into the trunk water main. The gap between pipes at a closing joint shall be minimised as much as practicable.

Collars are to be noted on the drawings as providing a gap no greater than 10 mm on pipes < DN750 and 20 mm on pipes ≥ DN 750.

On pipes < DN750, seal welds are required on collar joints to enable testing of the joint.

4.4.5 Steel Fittings

Steel fittings shall be factory fabricated and shall be manufactured from pipe produced by a manufacturer that is certified to AS1579.

Fittings shall be manufactured with sufficient strength and stiffness to withstand all hydraulic, earth and surface loads. Where the pipeline is operating at or near design maximum pressures, fitting strength shall be considered in the design calculations for the approved detailed design. Depending on the situation, additional reinforcement of the steel fitting may be required by increasing the localised thickness of the pipe. Steel tees, crotch plate reinforcement (also known as compensating rings) may be required. Where required, reinforcing plates, compensating rings or crotch plate reinforcement shall be designed and detailed on the Design Drawings.

4.5 GRP Pipeline Systems

GRP pipes and fittings shall not be used for trunk water mains.

4.6 Protection Against Degradation

4.6.1 Protection Against Damage to Coatings

Double thickness of PE sleeving shall be specified for insertion between coated fittings, valves and other appurtenances and thrust and anchor blocks. PE sleeving shall be 200 ± 20 □m thick, in accordance with AS 3680: Polyethylene sleeving for ductile iron pipe (2008).

Contractors shall be required to repair any damaged sleeving in accordance with the pipe and/or fitting manufacturer's instructions.

4.6.2 Cathodic Protection

Any mild steel or ductile iron pipe systems will be assessed in accordance with AS/NZS 2832 and AS/NZS 4853, with the resulting technical report referred to Unitywater for a decision on the requirement for cathodic protection. *Typically, Unitywater only requires cathodic protection on mild steel pipework. Refer to **Table 4b** for pipe material selection considerations.*

Cathodic Protection shall be considered as part of an overall system / asset-specific philosophy for the TWM and interconnecting assets. In addition, consideration of the existing CP system is required when determining if and how CP is to be installed for the new steel TWM works.

Mild steel trunk mains shall be designed to enable connection to adjacent or future Unitywater cathodic protection systems (if required). *This may be achieved by installing bonding at the ends of the steel pipework.*

Cathodic Protection is typically required where mild steel mains are:

(a) crossing a river
(b) crossing a railway
(c) fully or partially located within reactive soils (based on soil testing)
(d) fully or partially located within corrosive soils (based on soil testing)

Electrical isolation of fittings shall be provided at the flanges, where required, to prevent electrical current continuing along the pipeline (e.g. at flowmeters, valves in pits, etc.) or draining to ground via equipment in direct ground contact (e.g. buried valves).

Isolation of cathodic protection is preferred at all offtakes.

All scour valves, air valves and line valves, including equipment in direct contact with the ground are to be electrically isolated from the trunk main with the use of approved insulated bolt sets and gaskets, or isolating flanges.

When steel mains are laid in proximity to power lines, e.g. high voltage transmission lines and railway overhead power lines, the design of cathodic protection systems shall consider Low Frequency Induction (LFI) and Earth Potential Rise (EPR). *Earth mats may be required for fittings in these locations.*

Third party CP systems may also cause damage to Unitywater pipework. As such, the Designer is responsible for investigating and mitigating any adverse impacts on Unitywater assets from third party CP systems.

The cathodic protection Designer shall have a minimum of five years' experience in design, installing and servicing the types of systems required in the design.

Please note, ongoing maintenance costs of impressed current CP systems in Queensland are high, as these systems must be (re)registered/ every 5 (five) years. Consideration of whole of lifecycle cost shall be used to inform appropriate selection of TWM pipe material and arrangement.

4.6.3 Protection Against Contaminated Ground

A contaminated ground investigation and assessment shall be carried out by a suitably qualified independent consultant and shall:

(a) Recommend suitable pipe material/s to be used for trunk water mains located within contaminated land that shall be submitted to Unitywater for consideration and approval.

4.6.4 Bolted Connections

Refer to SEQ Code Standard Drawing SEQ-WAT-1313-1 for guidance on bolted connection requirements.

All buried bolted connections to be protected with a petrolatum system (such as Denso tape or equivalent).

5. General Design

5.1 General Requirements

5.1.1 Design Tolerances

Horizontal alignment shall be referenced in accordance with the SEQ D&C Asset Information Specification requirements, and where possible, to local property boundaries. Levels shall be referenced to AHD.

5.1.2 Environmental Consideration

Full details of the environmental management plan and mitigation works shall be shown on the Design Drawings and submitted to relevant Authority for approval.

A Site Assessment including access, tenure, environment and planning requirement shall be completed as part of the design process. *(Refer Unitywater documents Pr8856 Project Control Environmental Procedure and Pr11074 - CIPM - Site Assessment Procedure)*

Pipe Socket Direction

TWM pipework with socket connections shall be designed and detailed with sockets facing up grade. This is particularly important in the case of pipes ≥ DN900 or on grades > 1.5%.

Sockets may be laid facing grade down on grades ≤ 1.5% for short distances to avoid the necessity and cost of manufacturing a double socket transition piece.

5.2 Trunk Water Main Access

Access into water mains shall be provided for water mains ≥ DN750. The access facility shall be 600 mm diameter clear openings located at 1000 m maximum spacing. The locations of person access facilities shall be shown on the Design Drawings and Work As Constructed drawings.

Buried access facilities are not acceptable. TWM access facilities shall be located adjacent to the following where practical:

(a) trunk main tees (including air valve tees, scour valves tees, trunk main branches)
(b) isolation valves
(c) pressure reducing valves
(d) flow meters
(e) bends > 22 degrees
(f) where closing joints are used.

Where the TWM crosses a water course, TWM access shall also be provided on the creek bank to allow the lowest section of the TWM to be pumped out.

Refer to SEQ Code Standard Drawing SEQ-WAT-1404-1 for guidance on a typical TWM access arrangement.

5.3 Location of Water Mains

5.3.1 Water Mains in Road Reserves

5.3.1.1 General

Water mains are generally laid in road reserves. All mains in the road reserve shall be located in the TWM corridor as required by relevant road authority.

For the purpose of this clause road carriageways includes trafficable driveways into commercial and industrial premises.

For trunk mains located in road reserves, the following design requirements shall be evaluated and incorporated wherever practicable:

(f) Clearances from other utility services, such as electricity and telecommunication cables, gas mains, stormwater drains and sewers shall be specified. This is especially important where thrust blocks exist for bends, tees and valves as the thrust block size often needs the physical space of the adjoining Allocation to be properly founded for its design function.

Trunk water mains ≤ 300 NB shall preferably be installed in designated road service corridor where possible.

Where this is not possible, trunk water mains ≤ 300 NB may be installed in the road shoulder, or alternatively in the kerb side lane – subject to Road Authority and Unitywater approval.

Trunk water mains > 300 DN shall preferably be installed in the road shoulder, or alternatively in the kerb side lane. Trunk water mains > 300 DN shall not be installed in the road verge or footpath.

Local Council and State road TWM service corridors are not generally applicable to or relevant for mains > 300 DN.

Alignment of the trunk water mains within Council or State road reserves requires the prior approval of the relevant Road Authority/ies, before Unitywater will consider accepting the design.

Where a trunk main is to be located in the road shoulder, the spacing between the centre line of the main and the kerb shall be sufficient to enable a tracked vehicle to undertake TWM repair/replacement works without damaging the kerb and channel.

Trunk water mains shall have mechanical protection (i.e. be installed within a pipe enveloper or concrete encasement) where they are located under bikeways and/or roadways constructed of concrete.

Where applicable, trunk water mains shall be laid straight through roundabouts.

Where possible, a TWM shall be located on the alternate side of the street to the sewer location.

Where a proposed road crosses an existing AC water main or water main of any other material no longer approved by Unitywater, the trunk main shall be replaced/relocated to an appropriate alignment and constructed in an appropriate material for the location.

As AC mains are highly susceptible to damage from new works, changes in loading, pipe support and vibration, existing AC mains shall be not be protected using concrete encasement.

Where a TWM is required to be relocated, consult with Unitywater regarding the preferred and acceptable TWM alignments.

Refer to Clause 4.1 for information regarding appropriate/approved materials.

Where an existing TWM has mechanical protection (pipe enveloper or concrete encasement), and the proposed works require extension of the mechanical protection, consult with Unitywater regarding whether mechanical protection on the existing main is acceptable, or whether relocation of the main is required.

All TWM appurtenances shall be able to be accessible to maintenance vehicles and shall not be restricted by any proposed road upgrades or other improvements. In addition, TWM appurtenances shall be able to be operated from the finished surface level.

Minimising traffic impacts and the need for traffic control when operational and maintenance activities are undertaken shall be considered when determining the location of TWM appurtenances.

Appurtenances shall not be located in the trafficable section of the road carriageway.

5.3.1.2 Location in Footpath

Wherever practicable, the TWM shall be laid on the opposite side of the road to the sewer. As the sewer is usually laid on the high side, the water main, in such cases, will be laid on the low side.

5.3.1.3 Location in Carriageway

Where the TWM is proposed to be located in a road carriageway, written approval of the alignment and level of the main shall be obtained from the road authority and Unitywater.

5.3.2 Location in Other Than Dedicated Public Road Reserves

Permanent trunk water mains shall not be located within private property.

5.3.3 Water Mains in Easements

Refer to Table 5.2 in the SEQ Water Code for default easement guidelines.

If a temporary TWM cannot be placed in a road reserve, an easement will be required. In this circumstance, consideration shall be given to access arrangements for operational and maintenance reasons.

If scour valves are located within an easement, then consideration shall be given to obtaining easements for the drainage path of any water which may leave the pipe easement. Alternatively, pump-out scour arrangements may be considered.

5.3.4 Contaminated Sites

A register of contaminated land sites is held by the Department of Environment and Science (DES) Contaminated Land Unit. Details of works to be carried out on a contaminated site shall be referred to the Environmental Officer of relevant authority for approval.

5.3.5 Crossings

5.3.5.1 General

The design of TWM crossings of controlled access roads (e.g. motorways and major arterials), railways and waterways shall include mechanical protection of the main. The installation of pre-cast reinforced concrete slabs over the TWM as a means of providing mechanical protection is not permitted.

Mechanical protection shall preferably be provided by installing an enveloper pipe (encasing pipe). Where this is not practical, concrete encasement of the TWM may be considered and is subject to acceptance by Unitywater. *Refer to Cl 7.6.1 Concrete Encasement – General for guidance only regarding concrete encasement.*

All surface fittings shall be positioned outside the controlled road reserve, rail corridor/land or waterway embankments.

The design shall include drawings showing the reinstatement of road layers for open cut crossings. These details must be approved by the relevant corridor owner/Authority.

TWM crossings shall be designed as buried pipelines using trenchless techniques unless approved otherwise by Unitywater.

The Designer shall consult with the relevant reserve/corridor Authority to ensure Unitywater requirements as well as those of the relevant reserve/corridor Authority are satisfied as part of the design process.

The design of crossings shall consider:

- the ultimate width of the corridor/reserve being crossed, as well as the associated enveloper/concrete encasement extents.
- specific requirements of the reserve/corridor authority
- public utility plant crossings and clearances
- impact of proposed road pavement design over newly constructed main (where relevant)
- the temporary works requirements associated with the various construction methods

Refer Cl 5.4.10 for additional requirements where trunk water mains are located within railway reserve/corridor or rail land.

5.3.5.2 Requirements for Encased Pipe Installations

Only welded steel or butt-welded PE pipework shall be installed within encased pipes. A sufficient annulus dimension shall be specified so that the main can be secured in place using an approved spacer system. The annulus between the TWM and the encasing pipe shall be grouted. The ends of the enveloper pipe will require foam filled void filler prior to grouting.

Refer to Standard Drawings SEQ-WAT-1212-1, SEQ-WAT-1213-1 and SEQ-WAT-1214-1 for guidance only on typical arrangements

5.3.6 Railway Reserves

Where a TWM crosses a railway reserve/corridor or rail land, agreement on terms and conditions which is acceptable to Unitywater and the Railway Manager is required.

Refer to SEQ Code Standard Drawing SEQ-WAT-1213-1 for guidance only regarding typical buried water mains crossings railways.

5.3.7 Crossing of Creeks and Drainage Reserves

Acceptable options for creek and drainage reserve crossings include:

(a) mains laid under the creek bed

(b) mains attached to bridges

(c) mains laid within an enveloper/encasing pipe.

Where a creek or drainage crossing is proposed, consult with Unitywater regarding whether there is a preferred crossing arrangement, pipe material and jointing method to be used.

Refer to Clause 5.3 for TWM access requirements for mains ≥ DN750.

Refer to SEQ Code Standard Drawings SEQ-WAT-1211-1, SEQ-WAT-1312-1 and SEQ-WAT-1212-1 for guidance only regarding relevant creek/drainage crossing concepts.

5.3.8 Overhead Power Lines and Transmission Towers

Overhead power lines are a hazard for trenching and mechanical handling of pipes. Inducted currents in the TWM may be a safety hazard or induce corrosion. Water mains shall be located as far as practicable away from overhead power lines and transmission towers.

Investigations shall also be carried out, with reference to AS/NZS 4853, to determine potential safety risks where:

(a) welded steel pipelines simultaneously run parallel and close to high voltage power lines i.e. for more than 1 km parallel and within 500 m of powerlines >50 kV;

(b) metal pipelines are located within 5 m of a transmission tower; or

(c) metal pipeline access is within 50 m of a transmission tower.

NOTE: The above distances are indicative only

Where the distance from a metal TWM to a power line or transmission tower is within the distances stated in this Clause, an electrical study considering earth potential rise and low frequency induction, as well as a report detailing the procedures to be adopted for the construction and maintenance of the main, shall be provided by an RPEQ. This written report is to be provided to Unitywater before the detailed design is finalised and must form part of the Design Report.

Following report submission, the Designer is to consult with and incorporate feedback and requirements provided by Unitywater relevant Electrical and Cathodic Protection stakeholders.

5.3.9 Water Mains in Conjunction with Landscaping and/or Other Development

If at the time of preparing a TWM design it is known or reasonably expected that landscaping or development will take place over the installed water main, then the design shall address the following:

(c) Structural design – provision of a structural slab over the trunk watermain as a means of providing mechanical protection is not acceptable.

(h) Building over or near assets considerations - where practicable, trunk water mains shall be clear of landscaping and/or other development. Where it is not practicable, consult with Unitywater to obtain approval for any proposed landscaping and/or development.

5.3.10 Water Mains on Curved Alignments

Where trunk network layouts include curved alignments, the Designer shall determine the most appropriate pipeline material and/or combination of components to achieve the required alignments.

5.3.11 Location Markers

Refer to Example Project Drawings in Appendix TWM-A for guidance only regarding typical marker post arrangements.

Refer to SEQ Code Standard Drawings SEQ-WAT-1300-1 and SEQ-WAT-1300-2 for guidance regarding road and pavement markers, as well as identification marker posts.

On State controlled roads where kerb and marker posts are not able to be installed, marker plates and tags pinned to concrete crash barriers may be considered as a suitable alternative option by Unitywater.

5.4 Trenchless Technology

Where a PE TWM is installed using trenchless technology, only butt-weld pipe joints are accepted. Stress analysis shall be undertaken to verify pipe material performance under installation loading.

Where a mild steel TWM is installed using trenchless technology, only welded pipe joints are accepted.

Pipework with rubber ring joints (RRJ), flanged joints (FL), electrofusion (EF) joints or mechanical joints must not be installed using trenchless techniques or within mechanical protection (i.e. pipe enveloper or concrete encasement).

5.5 Shared Trenching

Common trenching for different/multiple Utility Entities shall not be permitted.

The minimum vertical and horizontal clearances between Unitywater trunk water mains and other utilities shall be in accordance **Table 5.5** contained within this document.

5.6 Connection of New Mains to Existing Mains

All works on the existing water supply system shall be considered as "live works" and will be controlled by Unitywater or their designated agent at the Contractor's cost. These works shall be clearly delineated on the Design Drawings and shown in sufficient detail such that the works can be readily constructed.

If the proposed trunk main crosses a roadway adjacent to the connection point, the full length of the trunk main at the road crossing shall be included in the "live works".

The connection point to the existing system shall be located to minimise disruption of supply to customers and be subject to Unitywater approval.

Refer to SEQ Code Standard Drawings SEQ-WAT-1105-1, SEQ-WAT-1105-2 and SEQ-WAT-1105-3 for guidance regarding connection details of new mains to existing mains.

A Unitywater Network Access Permit is required to be obtained for all works being undertaken near or over Unitywater infrastructure.

5.7 Termination Points

5.7.1 Temporary ends of water mains

In order to eliminate shut-offs, and disruption of services to existing customers, the main shall be terminated as required by Unitywater.

Future extension of the TWM shall be considered as part of the temporary end design.

5.7.2 Chlorination Assemblies

Chlorination/disinfection assemblies are required on all new mains to enable chlorination / disinfecting, swabbing (where required) and sampling for water quality testing purposes.

Chlorination/disinfection assemblies shall consist of the following elements, which shall be shown as part of the design:

(a) pitot point (chlorination/disinfectant injection point);

(b) swab entry and exit points (where required by Unitywater on specific works); and

(c) test point(s).

Test points shall be installed at the end of all new mains for the purposes of checking the disinfectant concentration during commissioning and operation of the mains.

Air valves may be used instead of pitot points (chlorination/disinfectant injection points) and test points.

Refer to SEQ Code Standard Drawing SEQ-WAT-1410-1 for guidance regarding chlorination test point arrangements.

5.7.3 Flushing Points

Flushing points shall not be installed on trunk water mains. Scours shall be used to drain and flush the trunk water main.

5.8 Property Services

Property Services shall not be installed on trunk water mains.

5.9 Obstructions and Clearances

5.9.1 Underground Obstruction and Services

5.9.1.1 Mains

The Designer shall confirm the position and depth all infrastructure (including any fibre optic conduit) has been accurately located by non-destructive methods such as hydro-vacuum potholing systems.

5.9.1.2 Clearance Requirements

For trenched and trenchless installations, clearances from other service utility assets shall not be less than (and preferably exceed) the minimum vertical and horizontal clearances shown in **Table 5.5**.

Water mains shall be located with sufficient clearance to structures to allow for maintenance and operation activities and provide protection against damage from pipeline bursts.

The minimum horizontal clearance between pipe enveloper/encasement extents and the closest TWM pipe joint clear of the enveloper/encasement shall be 600 mm.

Where new services interfere with an existing thrust block's integrity, then an engineering assessment is required to determine the minimum clearances (the minimum clearance shall be the larger of **Table 5.5** or the determined value).

Table 5.5 CLEARANCES BETWEEN UNITYWATER WATER MAINS AND OTHER UNDERGROUND SERVICES

Utility (Existing or proposed service)	**Minimum Horizontal Clearance to new Unitywater TWM (mm)**		**Minimum Vertical Clearance to new Unitywater TWM (mm)[1]**
	≤ 375 NB	**> 375 NB**	
SEQ-SP Water Mains[2] ≤ 375 NB	600[3]	1000	300
SEQ-SP Water Mains[2] > 375 NB	1000	2000	500
QBWSA[8] Water mains[2] ≤ 200 NB	300	300/600[9]	150/300[9]
QBWSA[8] Water mains[2] > 200 and ≤ 375 NB	600	600/1000[9]	150/300[9]

QBWSA[8] Water mains[2] > 375 and ≤ 600 NB	600	600/1000[9]	300/500[9]
QBWSA[8] Water mains[2] > 600 NB	1000	1000/2000[9]	300/500[9]
Gravity Sewers ≤ 300 NB	1000[5]/600	1000	500[4]
Gravity Sewers > 300 NB	1000[5]/600	1000	500[4]
Sewers - Pressure	1000[5]	1000[5]	500
Sewers - Vacuum	1000	1000	500
Gas Mains	600	1000	500
Telecommunication conduits and cables	600	600	300
Electrical conduits and cables	1000	2000	500[4,7]
Electrical and communication poles	1000	2000	N/A[7]
Stormwater Drains ≤ 300 NB	600[3]	1000	150[4]
Stormwater Drains > 300 NB	600[3]	2000	300[4]
Kerbs	600[6]	600[6]	900

Notes:

1. Vertical clearances apply where water mains cross one another and other utility services, except in the case of sewers where a vertical separation shall always be maintained, even when the main and sewer are parallel. The main should always be located above the sewer to minimise the possibility of backflow contamination in the event of a main break.
2. Water mains includes mains supplying drinking water and non-drinking water.
3. Clearances can be further reduced to 300 mm for distances up to 2 m where mains are to be laid past installations such as concrete pits**,** providing the structure will not be destabilised in the process.
4. Water mains (including water services and fire hydrant offtakes) should always cross over sewers, stormwater drains, gas mains and electrical conduits unless written approval is obtained from SEQ-SPs. For cases where there is no alternative and the main must cross under other services, the design shall nominate an appropriate trenchless construction technique in accordance with Clause 5.5 or other TWM construction and protection treatment (e.g. welded mild steel main within pipe enveloper or concrete encasement, which is effectively joint-free in the vicinity of other services.
5. Where a parallel sewer is at the minimum vertical clearance lower than the TWM (500 mm), maintain a minimum horizontal clearance of 1000 mm. This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance is increased to 750 mm.
6. Clearance from kerbs shall be measured from the nearest point of the kerb.
7. An additional clearance from high voltage electrical installations should be maintained above the

conduits or cables to allow for a protective barrier and marking to be provided.

8. QBWSA is the Queensland Bulk Water Supply Authority trading as Seqwater, established under the South East Queensland Water (Restructuring) Act 2007 (Qld). *For further information and requirements refer to:* https://www.seqwater.com.au/working-near-water-infrastructure
9. Larger minimum clearance applies when new Unitywater TWM size is > 375mm NB.

5.9.2 Deviations of Water Mains

5.9.2.1 General

Joint deflections in accordance with the pipe manufacturers recommendations may be used to achieve required pipe deviations

5.9.2.2 Horizontal Deviation of Water Mains

Horizontal deviation of trunk water mains shall be achieved by using:

- Joint deflections in accordance with the pipe manufacturer's requirements
- Bend fittings or welded mild steel pipes
- A combination of the above two methods

5.9.2.3 Vertical Deviation of Water Mains

Vertical deviation of trunk water mains shall be achieved by using:

- Joint deflections in accordance with the pipe manufacturer's requirements
- Bend fittings or welded mild steel pipes
- A combination of the above two methods

5.9.2.4 Curving of Pipes to Avoid Obstructions

Curving of ductile iron and mild steel pipes to avoid obstructions shall be in accordance with Cl 5.12.6.1, 5.12.6.2 and Cl 5.12.6.3.

Curving of PE pipes including limiting the radius of curvature shall be in accordance with both PIPA Guideline POP202 and the pipe manufacturer's requirements.

5.10 Reticulation Connections

Reticulation connections from a TWM shall be as agreed with Unitywater. Where a reticulation branch is to be installed off a trunk water main, the reticulation branch shall be a flanged tee and fitted with a double flanged metal seated gate valve or double flanged resilient seated gate valve.

6. Structural Design

6.1 External Forces

6.1.1 Pipe Cover

Water mains shall have sufficient cover to:

(a) ensure any vehicular loading that is in excess of the loading capability of the water main, is transferred to the soil strata beyond the water main;

(b) suit the height dimensions (locally) of fittings such as valves and hydrants

(c) meet the requirements of the road Authority (for water mains in road reserves); and

(d) meet any special requirements of the Unitywater

Standard minimum depths of cover for water mains shall be in accordance with **Table 7.2**. In areas that are subject to extremely cold conditions, cover shall be sufficient to prevent frost penetrating to the water main.

Table 7.2 MINIMUM DEPTHS OF PIPE COVER (mm)

Location	**≤ 200 mm NB**	**> 200 mm NB**
Non-trafficable areas, driveways, verges/footways	600	1,000
Carriageways of sealed local roads	600	1,000
Carriageways of unsealed roads	750	1,000
Carriageways of major roads, embankments	750	1,000
Industrial and Commercial Areas	750	1,000
Carriageways of motorways/freeways	1,200	1,200

Trunk mains ≤ 300 NB shall have a maximum depth to invert of 1.5m, unless a special design for the pipeline and its installation is submitted to and approval by Unitywater.

Trunk mains > 300 NB shall have a maximum pipe cover of 1.5m, unless a special design for the pipeline and its installation is submitted to and accepted by Unitywater.

Where a smaller pipe connects to a larger pipe, then the smaller pipe must achieve the required depth within 20 m. This may be achieved by pipe deflection; however, if adjacent services or pipe deflections do not allow this, then either:

- Welded mild steel bends shall be used when the larger pipe is mild steel; or
- flanged ductile iron bends shall be used when the larger pipe is ductile iron.

In a road carriageway, the depth of cover shall be measured from the road shoulder or lip of kerb.

Where site works will reduce the depth of cover below the required pipe cover, the main shall be redesigned to provide the required cover once site works are completed.

6.1.2 Pipe Embedment

Refer to SEQ Code Standard Drawings SEQ-WAT-1201-1, SEQ-WAT-1202-1, SEQ-WAT-1203-1 and SEQ-WAT-1204-1 & 2 for guidance on embedment types.

6.2 Geotechnical Considerations

A geotechnical investigation including field testing is required to determine ground conditions before detailed design of Unitywater infrastructure is undertaken.

As a minimum, field testing shall determine the presence of mining subsidence and acid sulphate soils (where relevant), as well as soil grading, soil bearing strength and Emerson Class to check dispersion.

Embedment support shall be suitable for the location and constraints encountered on site. Pipe/embedment support utilising hardwood piles is not permitted.

Geotechnical investigation along the TWM route is required to justify the trench design.

Filter fabric wrapped around the pipe embedment is required if the native soil is migratory.

If the native soil is non-cohesive, filter fabric around the pipe embedment is required if the grading analysis confirms the soil is classified as ‘sand’, in accordance with AS1726:2017 Geotechnical Site Investigations.

Migratory clay can be identified using the Emerson Dispersion Index test or the Pinhole test. Both tests shall be carried out if the soil bearing strength is < 50 kPa. Where soil bearing strength is $\geq$ 50 kPa, either the Dispersion Index test or Pinhole test shall be undertaken, as nominated by the Designer.

The bearing strength test requirement is not only related to whether the native material is migratory. It is used to determine whether a more onerous trench design is required. If the native soil is a very weak cohesive material, it can migrate into the trench and/or cause settlement of the pipe in the trench – a dispersion test does not identify this issue.

Table 7.2a provides guidance for designers regarding embedment support requirements.

Table 7.2a EMBEDMENT SUPPORT TYPE BASED ON NATA-CERTIFIED GEOTECHNICAL DATA

EMBEDMENT SUPPORT TYPE SHALL BE BASED ON REPRESENTATIVE NATA-CERTIFIED GEOTECHNICAL DATA FROM THE PROPOSED TRENCH DEPTH				
DISPERSION		**Soil Bearing Strength (kPa) [3]**	**Embedment support type**	**Requirement**
Emerson Class [1]	**Pinhole Test [2]**			
Not 1, 2 or 3	Not ND1 or ND2	> 50	Type 3/C is acceptable	NATA-certified test results only
1, 2 or 3	ND1 or ND2	> 50	Type 4/D minimum	NATA-certified test results only
Any value	Any valve	< 50	Specific Design	Interpretive report

Note:

1. AS 1289.3.8.1:2017 Methods of testing soils for engineering purposes - Soil classification tests - Dispersion - Determination of Emerson class number of a soil
2. AS1289.3.8.3:2014 Soil classification tests – Dispersion – Determination of pinhole dispersion classification of a soil
3. As specified on Drawing SEQ-SEW-1200-1, a special geotechnical assessment is required when soil bearing strength is less than 50 kPa. The resultant interpretive report must recommend design parameter values to be adopted for the design.
4.

The Designer shall provide an interpretive report when native soil is identified as having less than 50 kPa bearing strength. The certifying Design RPEQ shall address the report's finding in the design:

(a) justifying that a more onerous design is not required; or
(b) justifying whether one of the details shown on SEQ Code standard drawings (such as SEQ-SEW-1204-1) would be adequate; or
(c) providing a specific design, including whether structural support and/or filter fabric would be appropriate and if so, the type(s) required.

Note that SEQ-SEW-1204-1 also requires filter fabric to fully wrap the embedment.

It is incumbent upon the certifying design RPEQ to ensure that the correct filter fabric is specified.

Geotextile filter failures are grouped into four categories: inadequate design, atypical soils, unusual permeants, and improper installation, as follows:

- *poor fabric selection, poor fabric design, socked drainage pipe and reversing flow conditions.*

- *fine grained soils, gap-graded soils, dispersive clays and ochre.*
- *sludges, turbid water, alkaline water, leachates and agricultural waste liquids.*
- *intimate contact and completely adhesive clogging of surfaces.*

Refer to SEQ Code Standard Drawings SEQ-WAT-1201-1, SEQ-WAT-1202-1, SEQ-WAT-1203-1 and SEQ-WAT-1204-1 & 2 for guidance on embedment types A to N.

6.3 Concrete Encasement

6.3.1 General

Where mechanical protection of a TWM is required, using a pipe enveloper rather than concrete encasement is the preferred approach. Concrete encasement of trunk water mains requires prior Unitywater written approval.

For major roadways and railways, mechanical protection shall extend at least 2000 mm horizontally beyond the property boundaries. For water ways, mechanical protection shall extend at least 2000 mm horizontally beyond the riparian zone.

Non-flexible pavements (i.e. rigid concrete pavements) over the top of the TWM will not be acceptable as mechanical protection.

Where approved in writing by Unitywater, concrete encasement/surrounding works shall be carried out in one continuous pour without horizontal joints. Concrete shall be poured on only one side of the pipe until the concrete has risen at least 25% of the pipe diameter on the opposite side.

Where it is necessary to concrete encase a section of plastic pipe material, a heavy duty 3 mm thick polyethylene material shall be placed between the concrete and the PE pipe to minimise imposed loadings, particularly where the pipe emerges from the concrete block. In addition, plastic pipework installed within 1m of the concrete encasement limits, shall have cement stabilised sand pipe embedment to prevent potential pipe movement and settlement.

Only the following pipe material and jointing method shall be used where a TWM is concrete encased:

- Mild steel – welded joints
- PE – butt-welded joints
- Ductile iron – no joints (i.e. no RRJ, flanged or mechanical joints shall be located within the concrete encasement)

No pipe joints shall be installed within 600mm of the concrete encasement.

Rocker pipes (typically 600mm or 2 x NB long, whichever is larger) may be required:

- at each end of the transition from the concrete encased pipe to the natural trenched section of the main
- at each end where a TWM crosses over a rigid structure (e.g. a reinforced concrete box culvert)

Refer to SEQ Code Standard Drawing SEQ-WAT-1203-1 for guidance regarding concrete encasement (Type I) embedment.

6.4 Water Mains in Unstable Ground

6.4.1 General

All water mains proposed to be located within unstable ground, slip areas and mine subsidence areas shall as part of the design process and prior to commencing the detailed design:

(a) Have a geotechnical stability investigation and report prepared and certified by an appropriately qualified RPEQ
(b) Require a risk assessment to be undertaken following the geotechnical stability investigation in collaboration with Unitywater. The risk assessment shall specifically consider the appropriate pipe material and jointing to be used.

Risk mitigation measures may include continuous ground and pipework monitoring to be used to determine ground movement, as well as impacts to Unitywater infrastructure.

6.5 Above Ground Water Mains

Where above ground water mains are unavoidable, the following shall be satisfied:

(a) Pipes are to be supported on piles, cradles or alignment blocks as appropriate with detail designs addressing potential settlement and corrosion at supports.
(b) Pipes shall be laid with invert not less than 450 mm nor more than 900 mm above ground level.
(c) Retaining walls shall be provided where the pipe enters and leaves the trench.
(d) The position of the pipe shall be approved by the relevant Authorities where the pipe crosses creeks and other areas subject to Q100 flooding event.

Where relevant, the design shall incorporate allowance for expansion at bridge expansion joints and at ends of the bridge.

Above ground trunk water mains crossings creeks and waterways shall be designed to satisfy impact and debris loading requirements within *AS5100 Bridge Design*.

6.6 Pipe Anchorage

6.6.1 Thrust Blocks

6.6.1.1 General

All thrust restraints shall be reinforced concrete anchor blocks.

Pipe material, joint selection and ground condition shall be appropriately considered so that no thrust block exceeds 30m^3, regardless of the TWM diameter. *An alternative to standard thrust blocks may include bored piles*

Thrust restraints shall take into account future maintenance requirements and access to the trunk water main.

Thrust blocks and the zone of influence shall not protrude outside the easement or outside the space allocated in roadways.

Concrete thrust/anchor blocks shall not obstruct the removal of bolts and nuts at flanged joints.

6.6.1.2 Concrete Thrust Blocks

Thrust blocks shall be designed using the greater of following pressure requirements:

(a) 1200 kPa pipeline test pressure; and
(b) the System Test Pressure of the specific pipeline.

6.6.1.3 Timber and Recycled Plastics Thrust Blocks

Timber and recycled plastic thrust blocks shall not be used.

6.6.2 Restrained Elastomeric Seal Joint Water Mains

The use of restrained elastomeric seal joints on trunk water mains is not accepted by Unitywater. *This is to eliminate the potential WH&S risks associated with field team members unknowingly undertaking responsive repair works on this type of pipework.*

6.6.3 Restraint Requirements for Special Situations

6.6.3.1 PE Mains

Generally, a fully restrained PE pipe system does not require the use of anchorage. The restrained system may be provided through welded joints, restrained couplings or flanges. The Designer shall assess the need for pipe anchorage in any partially or fully restrained PE pipe system (e.g. ends of mains or transition between different pipe materials).

Valves shall be restrained to prevent shear loads being transferred to the PE pipe.

Refer to SEQ Code Standard Drawing SEQ-WAT-1206-1 for guidance only regarding typical thrust and anchor blocks for valves.

The transition areas between PE and other unrestrained pipelines (e.g. RRJ pipes) shall be appropriately restrained with concrete thrust blocks and/or thrust restraints. An unrestrained fitting installed on PE pipework is not permitted.

6.7 Bulkheads and Trenchstops

Bulkheads shall be provided for pipelines designed to be laid at abnormal grades in accordance with the SEQ Water Code **Table 7.5**. Bulkheads may also be required adjacent to the kerb and gutter shoulder of sealed carriageways to support the edge of the carriageway formation.

In addition to the grade of the water main, when determining the use of bulkheads and trenchstops, trench location, annual rainfall, native soil permeability, natural water table, the occurrence of underground streams and other Unitywater nominated criteria shall also be taken into consideration. Unitywater' consent in writing is required for the use of bulkheads and trenchstops. Where wide trenching with step batters is used, trenchstops and bulkheads should not extend above the lowest un-stepped trench section.

Where required, bulkheads and trenchstops shall be designed in accordance with AS/NZS 2566.2 and Table 7.5 of the SEQ Water Code.

When the grade is ≥30%, the pipeline shall be fully welded (i.e. welded mild steel pipe or butt-welded PE pipe).

Trench drainage shall not cause bolted fittings to become submerged for long periods of time.

Trench drainage shall not affect land use of property owners.

Refer to SEQ Code Standard Drawings SEQ-WAT-1209-1 and SEQ-WAT-1210-1 for guidance only regarding typical trench bulkheads, trenchstop and trench drainage arrangements.

7. Appurtenances

7.1 Valves – General

*Refer to **Appendix TWM-C** for a list of relevant Unitywater general mechanical specifications.*

*Refer to Example Project Drawing in **Appendix TWM-A** for guidance regarding stop valve arrangements ≤ DN450 on trunk water mains.*

*Refer to Example Project Drawing in **Appendix TWM-A** for guidance regarding typical valve pit arrangements for valves larger than DN450.*

7.1.1 Valve Siting Principles

Valves, hydrants and scours shall not be installed in road carriageways where an alternative location is available.

TWM valves < DN450 are not required to be installed within a valve pit, provided that no gearbox is required to operate the valve. An assessment of the running torque and on/off torque shall be undertaken based on hydraulic conditions on site. *High head applications may require a 4:1 gearbox and valve pit for access.*

All valves larger than DN450 shall be installed within valve pits.

Gate valves shall be installed upright.

7.1.2 Valve Pits

In all cases where a stop valve is installed within a valve pit, a thrust-type dismantling joint shall be provided within the valve pit, on the downstream side of the valve.

Thrust restraints shall be provided for line valves either in the walls of the valve pit or using line anchors.

Where practicable, valve pits shall be designed to self-drain and not be subject to reverse inundation.

Where this is not possible, the valve pit shall have a sump pit to assist in the use of pumping equipment to drain the pit. Pit lids shall have an opening through the pit lid to allow sump pump removal without entering the pit.

The valve pit drainage shall be appropriately designed by the Designer.

Permanent sump pumps shall only be provided in pits located in water charged ground or where valve pit is located in areas where frequent flooding or ingress via top slab / covers occurs.

For some valve pits, level sensors may be required to avoid valves being submerged for excessive time.

*Refer to Example Project Drawing in **Appendix TWM-A** for guidance regarding typical valve pit arrangements for valves larger than DN450.*

7.1.3 Nameplates

A nameplate manufactured from grade 316 stainless steel in accordance with AS 1449 Wrought alloy steels - Stainless and heat resisting steel plate, sheet and strip shall be fixed to the body of the valve by means of grade 316 stainless steel screws and stamped or engraved with the following information:

- tag number (provided by Unitywater)
- valve number
- manufacturer's name
- model / type descriptor
- size (DN)
- rated pressure
- weight
- date of manufacture.

A second identical nameplate shall be supplied loose.

A third nameplate shall be installed on top of the slab near the valve spindle cover or access opening with the following information:

- valve number
- direction to open
- number of turns to fully open
- "CONTACT UNITYWATER CONTROL ROOM BEFORE OPERATING THIS VALVE. Refer to Unitywater Network Access Permit for phone number to be used."

7.2 Stop Valves

7.2.1 Product Specifications

All valves shall be double flanged.

Wafer and lugged type valves shall not be used.

Knife Gate valves shall not be used.

7.2.2 Installation Design and Selection Criteria

7.2.2.1 Gate Valves

Resilient seated sluice gate valves shall not be used on trunk water mains. Only metal seated gate valves certified to *AS2638.1 Gate valves for waterworks purposes - Metal Seated* shall be used. Valves are to be manually operated unless directed otherwise by Unitywater.

All gate valves require gearboxes, shall be installed in a valve pit.

Under special circumstances and only with Unitywater approval, the valve chamber may provide access to the gearbox only.

7.2.2.2 Butterfly Valves

Butterfly valves shall comply to AS 4795.2 and be installed with the spindle in the horizontal plane and the lower part of the disc shall move in the same direction as the flow with the valve open. The valves shall be heavy pattern double flanged valves of the seal on body type. The sealing surfaces of the valves shall bed on the metal face of the pipework flanges and not on the cement lining.

7.2.3 Stop Valves for Transfer/Distribution Mains

Double isolation by closure of two isolation valves at adjacent sites shall be provided before confined space entry into the TWM is considered. *NOTE: If double isolation cannot be obtained a risk assessment must be undertaken on a project by project basis and a Safe Work Method Statement established and actioned as required.*

Isolation valves may be sized at 75% of pipeline diameter subject to pigging requirements and Unitywater approval.

Stop valve locations need to consider topography, accessibility, operational requirements, flooding, high risk areas, minimising water loss and minimising the quantity and duration of community water service disruption. High risk areas include but are not limited to the following: creek crossings, rail crossings, main road crossings, steep terrain, mine subsidence areas, sensitive environmental areas and locations where there is a higher risk of pipe failure e.g. acid sulphate soil areas.

Only metal seated gate valves (MSVs) shall be used on trunk water mains.

Refer to Clause 5.14 regarding acceptable stop valves for reticulation connections.

Tapered connectors may be concentric or eccentric as appropriate and subject to Unitywater approval.

For trunk water mains, valves spacing shall be provided to meet Unitywater operational and maintenance requirements. *Typically section valves should have a maximum spacing of 2km where there are only a few connections. Within the CBD or dense urban settings, maximum valve spacings of 1km should be considered. Trunk main drain down time between section valves should be ideally 4 hours and no more than 8 hours (i.e. one shift).*

7.2.4 Bypass of Stop Valve

The bypass valve connections shall not be cast integral with the main stop valve.

DN225 bypass valves and pipework shall not be used.

By-pass arrangements complete with gate valves are to be provided around all main line valves greater than DN300 unless directed otherwise by Unitywater.

The default sizes of bypasses for stop valves shall be:

(a) DN100 for water mains < 600 mm nominal bore;

(b) DN150 for water mains > 600 mm and < 1050 mm NB; and

(c) DN200 for water mains > 1050 mm and < 1200 mm NB.

Refer to SEQ Code Standard Drawings SEQ-WAT-1308-1 and SEQ-WAT-1406-1 for guidance regarding typical valve bypass arrangements.

7.2.5 Stop valves - location and arrangements

7.2.5.1 General

All valves shall be double flanged.

Refer to SEQ Code Standard Drawing SEQ-WAT-1103-1 for guidance regarding typical distribution and transfer main arrangements.

7.2.5.2 Arrangement 2

Where a stop valve is located on the opposite side of the road to the trunk main, the pipework between the tee and the valve shall be thrust restrained.

7.3 Control Valves

7.3.1 Pressure Reducing Valves (PRV)

Refer to SEQ Code Standard Drawing SEQ-WAT-1309 set for guidance regarding typical appurtenance installation arrangements for passive and active pressure reducing valves (PRV).

7.4 Air Valves (AV)

7.4.1 Installation Design Criteria

Air valve arrangements shall comply with, inter alia, the following requirements:

(a) Air valves shall be located within pits that have access lids located at the finished surface level;

(b) All valves shall be no deeper than 1.5m below the finished surface level;

(This is to reduce complications when inspecting as well as undertaking operations and maintenance activities)

(c) the minimum cover to the TWM is $\geq$ 1.0m;

(d) An isolation valve shall be provided adjacent to air valves to facilitate air valve maintenance. The isolating valve used with air valves shall be a double flanged butterfly valve with lever and be the same size as the air valve. For DN100 air valves, a combined hydrant isolator fitting shall be used in-lieu of isolation valve;

(e) Where the air valve is offset from the trunk main (usually in instances where the trunk main is within the sealed section of the road pavement), an additional isolation valve may need to be installed on the offset pipework at the branch from the TWM – refer to Unitywater for requirements;

(f) The isolation valve/s associated with the air valve arrangement shall be operable from finished surface level;

(g) Concentric reducers on offset air valve arrangements are not permitted;

(h) Pressure test points are to be incorporated in all air valve assemblies to enable pressure test gauges to be manually connected for testing;

(i) Air valves on pipes less than DN750 shall include a branch equal to the air valve size.

(j) Air valves on pipes DN750 and greater shall include a DN600 access branch also serving as an air collection chamber; and

(k) Following a hydraulic and pressure transient analysis being undertaken, all valves and associated valving arrangements shall be appropriately selected and designed respectively, to ensure they are suitable for the range of operating conditions that will be experienced.

*Refer to Example Project Drawings in **Appendix TWM-A** for guidance regarding typical air valve arrangements.*

7.4.2 Air Valve Size

Air valves shall be sized based on filling and draining requirements and minimum drain down times. The Designer shall undertake air valve sizing and selection in consultation with Unitywater.

Transient analysis is unlikely to affect air valve selection as air valve activation is not permitted during sub-atmospheric conditions.

7.4.3 Air Valve Locations

When required on large mains, air valves shall be located:

(a) At summits (high points).

(b) At intervals of not more than 800 m on long horizontal, ascending and descending sections.

(c) At significant increase in downward slope (See SEQ Water Code Figure 8.23).

(d) At significant reduction in upward slope (See SEQ Water Code Figure 8.23).

(e) On the downstream side of PRVs.

(f) On the downhill side of major isolating valves.

(g) At blank ends.

(h) As close as possible to property boundaries or existing fence lines to avoid impacts on the landowner and the private property.

7.4.4 Use of Hydrants as an Alternative to Air Valves

For pipelines less than 450 NB, fire hydrants may be used in lieu of air valves with the approval of Unitywater. *Typically, hydrants on trunk water mains are used in instances where the grade of the pipeline is relatively flat and there is potential for localised air entrapment to occur – especially during re-filling.*

Where Unitywater approves hydrants to be installed on a trunk water main, an approved hydrant/isolator fitting with a DN100 flange shall be used.

*Refer to Example Project Drawing in **Appendix TWM-A** for guidance regarding a typical TWM hydrant arrangement.*

Where hydrants are installed as an alternative to an air valve, the hydrant will have identification markings consistent with those used for air valves. These hydrants must not be used for fire fighting purposes and they **shall not** have identification markings the same as a typical hydrant.

7.5 Scours and Pump-Out Branches

7.5.1 Scours - Location and Arrangements

Unitywater requires scours for water mains > 200 NB.

A flanged scour tee shall be used at the scour branch.

*Refer to Example Project Drawings in **Appendix TWM-A** for guidance regarding typical scour arrangements.*

Refer to SEQ Code Standard Drawing SEQ-WAT-1307-2 for guidance regarding typical scour details.

7.5.2 Design

Scours and pump-out branches are provided in the distribution network for maintenance purposes. They are designed to allow draining of water from the mains by gravity or use of a mobile pump.

Scours are also provided for the removal of sediment.

At creek and river crossings, the scour tee and the scour outlet shall be installed at a level equal to or just higher than the mean water level in the watercourse.

The design drawings shall detail appropriate erosion protection and control measures (e.g. headwalls, stone pitching, etc.).

A dewatering pit may be required to de-chlorinate the water before discharge. The discharge of chlorinated water shall comply with the Unitywater Site Assessment requirements. *Refer to Unitywater document Pr11074 - CIPM - Site Assessment Procedure.*

Scour arrangements may include the use of an orifice plate to manage discharge velocities through the scour, as well as prevent scour valve cavitation. Consult with Unitywater where an orifice plate is proposed.

Scour arrangements shall:

(a) drain the TWM by gravity and/or have provision for pump out within a specified time in accordance with **Table 8.3**;

(b) have a diffuser fitted at the discharge point if there is a likelihood of environmental orasset damage;

(c) not be subject to inundation from a flood due to a Q2 storm event;

(d) be located so as to permit safe access and operation;

(e) be appropriately located so that they are not submerged for extended periods of time;

(f) take into consideration the receiving environment and the local surrounding where the scour discharges, and the potential need for any drainage easement; and

(g) not erode/damage the local Authority's infrastructure/assets (e.g. headwalls, drains, etc.) due to operating the scour valve.

Table 8.3 MAXIMUM TWM DRAINAGE TIMES

Main size Nominal Bore (NB)	Maximum drainage time h
< 375	1
375 - 750	2
> 750	4

7.5.3 Scour Size

Scour sizes are based on the need to drain a section of main within a time stipulated in **Table 8.3**. Scours shall be sized in accordance with **Table 8.4**.

Table 8.4 MINIMUM SCOUR SIZE

Main size Nominal Bore (NB)	Scour Branch Diameter (minimum)
≤ 200	80
> 200 - < 375	100
> 375 - ≤ 750	150
> 750	200

7.5.4 Scour Location

Scours shall be located at:

(a) low points at the ends of water mains;

(b) low points between in-line stop valve; and

(c) at the end of the trunk main to meet chlorination and maintenance requirements.

Scours shall drain to a point where the discharge is readily visible and accessible, to prevent the scour valve inadvertently being left open.

Typical discharge locations include:

(i) *an approved open stormwater structure, or a pit that should be pumped out each time the scour is operated (sometimes called a pump scour);*

(ii) *an open grated street drainage gully; and*

(iii) *a natural water course (with energy dissipater).*

Scour locations need to consider topography, accessibility, operational requirements, flooding and suitability of environment for discharge.

7.6 Swabbing Points

Swabbing points are not required under normal conditions.

Swabbing/pigging stations are usually only required where flow velocities are low, which typically occurs where only early stage development is being supplied off a TWM that has been sized based on ultimate demand.

Provided that initial flow in the trunk water mains provides a shear stress > 4 kPA, swabbing points in the TWM will not be required, unless directed otherwise by Unitywater.

All proposed swabbing points require Unitywater approval.

Refer to SEQ Code Standard Drawing SEQ-WAT-1318-1 for guidance regarding typical swabbing chamber arrangements.

7.7 Hydrants

Hydrants on trunk water mains shall not be used unless approved by Unitywater. Hydrants shall only be installed on trunk water mains for localised manual air release purposes.

Refer to Clause 8.4.6 regarding the use of hydrants as an alternative to air valves.

7.7.1 Hydrant Types

Combined hydrant/Isolation valve assemblies shall be used where hydrants are required to be installed on trunk water mains. All hydrants shall be spring hydrants.

*Refer to Example Drawing in **Appendix TWM-A** for guidance only regarding combined valve/hydrant arrangements and associated access pit.*

7.7.2 Hydrant Size

Spring hydrants shall have 100 mm NB risers and DN100 flanges.

Where PE pipe material is accepted by Unitywater, the PE flange that connects to the hydrant shall be full face with SS316 backing rings and the bolting configuration shall match the DN100 flange on the hydrant. Butt-welded joints shall be used for PE hydrant arrangements (including tees).

7.7.3 Hydrant Spacing

Hydrants on trunk water mains shall not be used unless approved by Unitywater. Hydrant spacing/location for trunk water mains shall be determined in consultation with Unitywater.

There are no minimum or maximum spacing requirements for hydrants located on trunk water mains, as these hydrants are intended for localised air release requirements purposes, rather than fire fighting purposes.

Disregard Appendix H of the SEQ Water Code.

7.7.4 Hydrant Location

Where Unitywater requires a hydrant to be installed on a trunk water main, the hydrant shall primarily be located to effectively enable localised manual air release from the trunk main to be undertaken. If possible, it is also preferable for the hydrant to be located in line (+/- 200 mm) with the side real property boundary, to minimise potential impacts to local residents.

7.8 Disinfection Facilities

7.8.1 General

Disinfection and water quality requirements shall be in accordance with SEQ Water Code Appendix I – Disinfection of Water Mains and Water Quality Compliance Specification.

Swabbing is not required by Unitywater under normal conditions as per Clause 8.7 and Clause 18.1.

Refer to SEQ Code Standard Drawing SEQ-WAT-1410-1 for guidance regarding a typical chlorination test point detail.

7.9 Surface Fittings

7.9.1 General

The design of surface fittings shall consider safe access for the operation of the fittings.

Refer to SEQ Code Standard Drawings SEQ-WAT-1305-1 and SEQ-WAT-1306-1 for guidance regarding typical valve surface boxes arrangements where the isolation valve is ≤ DN450 in size.

7.9.2 Marking of Surface Fittings

Hydrants on trunk water mains are not intended to be used for fire-fighting purposes and shall have identification markings consistent with an air valve.

Refer to SEQ Code Standard Drawing SEQ-WAT-1300-1 for guidance regarding typical surface fitting pavement markers.

7.10 Appurtenance Location Marking

7.10.1 Marker Posts and Plates

Marker posts shall be installed adjacent to the appurtenances, but clear of the road carriageway.

All marker posts for the non-drinking water components shall have the non-drinking water sign or letters NDW added to the lettering on the indicator plates and top of the marker posts painted purple.

Refer to SEQ Code Standard Drawing SEQ-WAT-1300-2 for guidance regarding typical surface fitting identification marker posts.

7.10.2 Pavement Markers

The pavement markers shall meet the requirements of the relevant road authority.

Refer to SEQ Code Standard Drawings SEQ-WAT-1300-1 and SEQ-WAT-1300-2 for guidance regarding typical surface fitting pavement markers and identification marker posts.

7.11 Flowmeters

A flowmeter shall not be directly buried. Flowmeters shall be installed within pits.

*Refer to Example Project Drawings in **Appendix TWM-A** for guidance regarding typical flowmeter arrangements.*

7.11.1 Sample Points

Sample points are to be detailed on the design drawings and installed during construction. The number and location/s for the sample points shall be approved by Unitywater.

8. Design Review and Drawings

8.1 Design Drawings

8.1.1 General

All design drawings shall be clear, uncluttered, without conflicting/illegible text/linework; at a scale that achieves these objectives and in accordance with the SEQ D&C Asset Information Specification (AIS).

8.1.2 Scale

All drawings shall comply with scale requirements in the SEQ D&C Asset Information Specification.

8.1.3 Content of Design Drawings

The content of the Design Drawings shall be in accordance with this TWM Code and the SEQ D&C Asset Information Specification.

8.1.3.1 Locality Plan (refer to SEQ AIS for additional requirements)

Generally the following information relevant to the proposed TWM installation works shall be shown on the Locality Plan:

(a) the location of the development relative to surrounding areas;

(b) the property or development boundary shown with a heavy line;

(c) existing and proposed road boundaries;

(d) sufficient street names and major topographical features to easily locate the development;

(e) sufficient details of the local mains to clearly show the scope and extent of the "live connection works"; and

(f) the UBD map reference number (where available).

8.1.3.2 Site Plan (refer to SEQ AIS for additional requirements)

Generally the following information relevant to the proposed TWM installation works shall be shown on the Locality Plan:

(a) cadastral information including streets, street names, lot boundaries and numbers and easement locations;

(b) proposed and existing water mains diameter (DN), material type, pressure class (PN), diameter;

(c) TWM location (offset) from property boundary;

(d) "Live" water connections to be built, including mains and fittings;

(e) mains to be substituted and associated fittings;

(f) mains to be disused;

(g) sufficient details of the existing system for the "live connections";

(h) Unitywater "As Constructed" reference or file number for all existing mains affected by the live connections;

(i) list of all proposed fittings, including "live" connections. The lists shall be located near the point of placement on the plan;

(j) diagrammatic sketch of pipe fitting arrangements;

(k) hydraulic force in kN and direction indicated by an arrow at each bend, junction and dead-end (refer SEQ Code Standard Drawing SEQ-WAT-1205-1);

(l) details of all existing and proposed structures and utilities that may affect the works, including the cover, size and alignment;

(m) overhead high voltage power lines and support towers;

(n) water service sizes, material and entry points for each lot;

(o) location of service conduits;

(p) allotments with zero lot alignments; and

(q) a bold line drawn around the development property or site.

(r) all mild steel pipe specials shall be detailed.

8.1.3.3 Tabulations (**refer to SEQ AIS for additional requirements**)

The following tabulations and its details shall be shown on the drawings:

Asset register:

(a) name of Subdivision or Development;

(b) Development site address;

(c) application numbers from relevant Unitywater delegate;

(d) Unitywater delegate approval date;

(e) material and total length of each diameter of main;

(f) date works complete; and

(g) Drawing or Detail Plan numbers.

TWM New Asset Details

(a) street name;

(b) length, diameter and material of each main;

(c) “As constructed” folio and year;

(d) number of air valves on the length of main;

(e) number of isolation valves on the length of main;

(f) number of scour valves on the length of main;

(g) number and type of cathodic protection locations on the length of main;

(h) number, type and size of PRVs on length of main;

(i) number of water quality sampling points on the length of main;

(j) number and size of pigging/swabbing points on the length of main; and

(k) number, size and type of flowmeters on length of main.

Unitywater Connections and Substitution

(a) street name and location;

(b) length, diameter and material of each main; and

(c) commencement and completion date.

Disused Mains

(a) street name;

(b) length, diameter and material of each main;

(c) "As constructed" folio and year;

(d) number and type of fittings removed, including asset numbers, on the length of main;

8.2 Recording of Work As-Constructed Information

The design drawings shall be prepared so that the as-constructed information can be readily incorporated and comply with Unitywater ADAC requirements contained within the current SEQ D&C Asset Information Specification.

All Operations and Maintenance (O&M) Manuals provided to Unitywater at Asset Handover shall be reflective of the as-constructed information.

PART 2: CONSTRUCTION

9. General

9.1 Scope

Construction of Unitywater assets shall comply with all relevant Australian Standards, local, state and federal by-laws, building approvals and current legislation requirements. Construction requirements shall include, but not be necessarily limited to the following requirements:

(a) Unitywater Technical Requirements – refer **Appendix TWM-C** for details regarding relevant Unitywater documents
(b) Safety in Design
(c) Community and stakeholder consultation
(d) Unitywater Planning and Design requirements
(e) Delivery of all materials including pipes, mechanical couplings, fittings and valves
(f) Protection and safe storage of all products and materials
(g) Visual inspection of all line pipes, mechanical couplings, fittings and valves from the suppliers and report defects before installation
(h) Laying and jointing of pipes
(i) Repair of pipe coatings
(j) Supply and application of field coatings to mild steel pipes and flanged joints
(k) Supply and installation of all concrete thrust blocks, bulk heads, pipe supports, pipe welding, etc. required for the anchoring of line pipes and fittings as nominated on the drawings
(l) Location, exposure and protection of all existing services and public utilities along the pipeline route impacted or potentially impacted by construction
(m) All dewatering and groundwater disposal in accordance with the Environmental Management Plan and Environmental Work Method Statements developed
(n) All activities relating to spoil handling and disposal in accordance with the Environmental Management Plan and Environmental Work Method Statements
(o) All activities related to the filling, disinfection, flushing, testing and commissioning of the pipeline
(p) All activities related to obtaining and undertaking work in accordance with Unitywater Network Access Permit/s;
(q) All activities related to the reinstatement of works areas such as roads, landscaping, temporary and permanent protection structures, etc.

In addressing the above requirements, construction of the TWM shall be in accordance with the accepted design documentation.

10. General Construction

10.1 General

10.1.1 Personnel Qualifications

During any construction activity at least one person on site must have completed a pipe laying training course approved by the supplier and appropriate to the pipeline under construction. The training course must have been completed within the last 10 years.

The Contractor will provide documented evidence of such qualification to Unitywater prior to commencement of the works.

10.1.2 Inspection and Test Plans

The Contractor shall submit inspection and test plans (ITPs) to the Unitywater representative for verification before commencing work on activities covered by the project quality plan. The ITPs shall include where applicable observations, measurements or tests at the Contractor's facilities.

10.2 Protection of Property and Environment

10.2.1 Protection of Other Services

The Project Proponent or its Contractor/s shall be responsible for any damage they cause to existing services. If the Project Proponent or its Contractor damages any existing services, they shall arrange for the relevant service authority to make good such damage and the cost thereof shall be borne by the Project Proponent or its Contractor. If in the opinion of Unitywater, the failure or damage causes an emergency situation, then remedial action will be taken by Unitywater and the full cost of such action shall be borne by the Project Proponent or its Contractor.

10.2.2 Disused/Redundant Water Mains

All fittings, walls, etc. related to the pipeline need to be removed entirely or removed to a depth of at least 600 mm.

11. Products and Materials

11.1 Authorised Products and Materials

11.1.1 General

All pipe materials and fittings shall be approved by Unitywater. All materials and fittings shall be installed to the manufacturer's specifications.

*Refer to the current SEQ Code Accepted Civil and Mechanical Infrastructure Products and Materials Lists **for guidance only** regarding products accepted by Unitywater.*

11.1.2 Pressure Pipes and Fittings

All pipe materials and fittings to be used in Unitywater TWM network shall be authorised by Unitywater.

The SEQ Code Civil & Mechanical Infrastructure Products and Materials List are not intended for trunk infrastructure and should be used as guidance only.

All material and fittings shall be installed to the manufacturer's specifications.

Installation of pipes and fittings shall comply with the following:

PVC Pipe:

PVC shall not be used for trunk water mains.

Ductile iron pipe and fittings:

Ductile iron pipes shall not be cut within 1.5m of the socket and in general the minimum length of spigot-spigot ductile iron pipe shall be 600mm.

(This requirement relates to outer diameter of ductile iron pipe varying within this length which can cause incorrect seal at the rubber joint. Short lengths of pipe have the potential to compound joint rotation increasing the possibility of spigot and socket disengagement.)

FBE Coated Flanges:

FBE coated flanges shall be joined by Grade 316 stainless steel bolts, nuts and washers. The flange connections and associated bolts shall be covered with a protective wrapping (e.g. Denzo wrapping or equivalent) to ensure bolt threads stay clean and free from material.

Restrained Joint Rubber Sealing Rings

Restrained joint rubber sealing rings shall not be used on trunk water mains.

Mild Steel Pipes and Fittings – Weld Collar Joints

Weld collars for steel pipe jointing shall satisfy the following requirements:

- Be manufactured from Grade 250 rolled plate
- Have minimum thickness of 6mm
- Have a minimum yield strength of 250 MPa
- Have a minimum width of 150mm.

The external coating of the pipe shall be terminated 100mm to 125mm from the pipe ends, and spiral welds shall be ground flush in this zone.

Welded joints shall be checked with a pneumatic test of the weld integrity. An air nozzle shall be attached to the pipe plate in the air space between the welds, and the annulus pressurised to 100 kPa to check the weld for leaks.

Mild Steel Pipes and Fittings – Welded Slip-In Joints (SSJ)

Slip-in type joints shall be suitable for field welding from the outside only.

The pipe overlap at the slip-in joint shall be the greater of:

- three (3) times the pipe wall thickness; and
- 30 mm.

The spigot pipe end shall have mortar lining finished flush with the pipe end. The belled pipe end shall have the mortar lining terminating short of the pipe end, so that the gap of the cement mortar lining at the pipe joint is no greater than 15 mm. Exposed steel (not fusion bonded epoxy coated or cement lined) shall be protected with 2 pack epoxy approved for use in drinking water.

Mild Steel Pipes and Fittings – Rubber Ring Joint (RRJ)

RRJ pipes shall be jointed in accordance with manufacturer's requirements. At all locations around a joint, irrespective of whether the pipes forming the joint are deflected or not, the pipe manufacturer's recommendation regarding minimum depth of penetration of the spigot into the socket shall be attained.

RRJ mild steel pipework shall be electrically continuous over its entire length. To provide electrical continuity, an electrical continuity cable shall be installed over each rubber ring joint.

Mild Steel Pipes and Fittings – Flanged Joints

Flanged joints shall conform to the requirements of AS 4087 (for pipes up to and including DN1200). The flanges shall be raised face steel flanges. Flanges shall comply with AS 4087 Figure B.7 unless connecting to existing pipe, in which case the connecting flange shall match existing.

Bolts, nuts and washers shall be stainless steel. Nuts and bolts for flanged fittings shall comply with AS 4087 Appendix C. All flanges shall be drilled off-centre. Flanges shall have a minimum pressure rating PN16.

Buried joints shall be protected by a corrosion protection wrapping system approved by the pipe supplier for a 100 year life of the whole pipeline. Insulation joints shall be provided where dissimilar metals are flange jointed.

Refer SEQ Code Standard Drawing SEQ-WAT-1313-1 for guidance regarding typical bolting details for flanged joints.

Mild Steel Pipes and Fittings – External pipe coating reinstatement at welded joints

Reinstatement of the external pipe coating at all welded joints shall be undertaken using heat shrink sleeve system (Raychem, Canusa or equivalent) or petrolatum tape wrap system (Denso or equivalent), in accordance with the manufacturer's requirements.

Polyethylene Pipes and Fittings

PE pipework and fittings shall be butt-welded unless approved otherwise by Unitywater.

All jointing of PE pipework and fittings shall be carried out by a suitably qualified and experienced person.

PE pipe has a high coefficient of expansion (0.18mm/m/^{o}C) and must be installed in the trench such that no thermal induced stresses develop in the pipe or fittings.

The backfilling of side support and overlay zones shall not be placed when the ambient temperature adjacent to the pipe falls outside the range 12-27^{o}C. The pipe shall be snaked horizontally in the trench to allow for thermal movement.

All PE pipes > DN315 shall be supplied with a "Certificate of Compliance" from the pipe manufacturer confirming compliance with AS/NZS 4130 Polyethylene (PE) pipes for pressure applications, AS/NZS 4131 Polyethylene compounds, PIPA POP004 Polyethylene pipe and fittings compound.

The certificate shall include inter alia:

(a) Product Specification sheets
(b) Product Certificate of Analysis (for all batches)
(c) QA Production Performance Sheets
(d) OIT Testing Results, including details on thermal stability in relation to pipe size
(e) Extrusion Report sheets, including details on speed, melt temperature control extruder throughput.
(f) Extrusion Line checklists, including wall thickness tolerances
(g) Ovality Check sheets

All PE flanges shall be full bore and full face, with a 316 SS backing ring.

12. Pipe Laying, Jointing and Connecting

12.1 Installation of Pipes

12.1.1 Laying

PE Pipe

In the case of PE systems, PE has a relatively high co-efficient of thermal expansion. When long lengths of welded pipe are being installed in warm weather, the excavation backfill shall be placed as soon as practicable. This will allow the pipe to cool to ambient temperature and contract fully before making lateral connections or tying-in to an existing network.

Pipes strings shall be assembled on pipe rollers. The method of handling and installing the pipe strings shall not overstress the pipe structure.

Pipe installation and backfilling, as appropriate, shall be carried out in the early morning whenever practical. This is to minimise pipe contraction on cooling. Particular care shall be exercised when installing the pipe in the vicinity of tees or other fittings which are required to be positioned at a precise chainage.

Weld pre-qualification and testing of PE pipes and fitting shall be undertaken in accordance with WSA 01 Polyethylene Pipeline Code of Australia, Version 3.1 (2004). Additional weld testing may be required, as directed by Unitywater.

12.2 Authorised Products and Materials

12.2.1 Curving of Pipe

Curving of PE pipe shall comply with both the PIPA guidelines POP202 and the pipe manufacturer's requirements.

At the time of writing, the minimum allowable bend radius as per PIPA guidelines POP202 is:

- *15 x Pipe OD for PE100 PN16 (SDR11) pipe*
- *12 x Pipe OD for PE100 PN20 (SDR9) pipe*

12.3 Marking Tapes

12.3.1 Non-detectable Marking Tape

Non-detectable marking tape shall not be used on trunk water mains.

12.3.2 Detectable Marking Tape

Only detectable tape shall be used. Lay tape on top of the pipe embedment. Lay the tape over the embedment to form a continuous connection between valves and/or hydrants. Strip the ends of the tape to expose its conducting wires. Connect bare wires to a nut or bolt of a valve or hydrant to form an electrical connection of the wire to the valve or hydrant.

12.3.3 Tracer Wire

Where trenchless installation is used, install an approved tracer wire with the pipe and attach each end of the tracer wire to a valve or hydrant as per Clause 15.12.2.

12.4 Valves, Hydrants and Surface Boxes and Fittings

12.4.1 Distance between Fittings

Distances between adjacent socketed fittings shall be separated by a 600 mm long straight length of pipe.

12.5 Flanged Joints

Refer SEQ Code Standard Drawing SEQ-WAT-1313-1 for guidance regarding typical bolting details for flanged joints.

12.6 Welding of Steel Pipes

12.6.1 Reinstatement of Cement Mortar Lining

Due to confined space entry constraints, it is not possible to reinstate the cement mortar lining of welded pipes < DN750.

For pipes < DN750, treat the unlined internal surface (i.e. projection beyond cement mortar lining of the joint) as specified in the relevant WSAA Product Specification or WSAA appraisal.

12.7 Welding of PE Pipelines

Butt fusion (and electrofusion where approved by Unitywater) welding may be used for joining pipe -to-pipe or fitting-to pipe. All welding shall be performed by welders who have successfully completed training by a Registered Training Organisation, endorsed by the Plastics Industry Pipe Association for the relevant welding method(s), fitting type(s) and pipe/fittings size(s).

PE welds and weld testing shall conform to the requirements of Pr9904 – Specification for Pressure Pipe Construction.

Refer to the Plastics Industry Pipe Association who provides the following technical guidelines for electrofusion welding – POP001 and butt welding – POP003.

Weld pre-qualification and testing of PE pipes and fitting shall be undertaken in accordance with Pr9904 – Specification for Pressure Pipe Construction and WSA 01 Polyethylene Pipeline Code of Australia, Version 3.1 (2004). Additional weld testing may be required, and shall be undertaken by the Contractor, as directed by Unitywater.

Where possible, all PE welding parameters and information shall be accurately recorded for every welded joint undertaken, via the proprietary Quality Assurance welding software application of the PE welding box supplier. This information shall be provided to Unitywater in both written and electronic formats, prior to the works going 'On-Maintenance'.

12.7.1 Repairs

Permanent repair of PE pipelines generally involves cutting out the damaged section and replacing it with a new pipe using fusion jointed or mechanical thrust restraint couplings.

13. Pipe Embedment and Support

13.1 Embedment Materials

Embedment material for water mains shall be 5 or 7 mm nominal single sized aggregate as per WSA PS-351.

13.2 Compaction of Embedment

13.2.1 Compaction Trials / Pre-qualification of Embedment Compaction Method

13.2.1.1 General

With reference to Clause 19.3.3.1, pre-qualification of the pipe embedment material and process, as detailed below, is an alternative to conducting embedment compaction testing of pipes of size ≤ 300 mm (DN355 PE).

13.2.1.2 Test Method

Install a length of pipe at least 4 m long in a trench having minimum side clearance of 200 mm and in native soil having a bearing capacity > 50 kPa. Bed the pipe and place and compact embedment in accordance with Clauses 16.1 to 16.3.1 inclusive.

Record the Product Specification or equivalent specification to which the embedment material conforms. Record the compaction method in a format suitable for use as an on-site work instruction.

Conduct compaction testing at the spring line of a complete embedment zone and along the pipe length at its mid-point and at locations 1 m either side. Assess results of compaction tests for compliance with SEQ Water Code Table 19.1 as appropriate. Record compaction tests results.

Retain records of the compaction method and trial reports.

13.2.1.3 Interpretation and Applicability

Provided that all compaction test results conform to the requirements of Table 19.1, as appropriate, pre-qualify the compaction method for pipelaying subject to:

(a) the diameter of the pipe being the same as that used in the pre-qualification test;

(b) the actual embedment material used in construction being the same as used in the pre-qualification test;

(c) the documented pre-qualified compaction method being used; and

(d) the native soil having a bearing capacity >50 kPa.

13.2.2 Compaction Control

Compact the embedment zone to comply with SEQ Water Code Table 19.1, as appropriate.

Undertake embedment compaction testing as specified in Clause 19.3.3.

14. Swabbing

14.1 General

Swabbing is not required by Unitywater under normal conditions unless specified by Unitywater on a case by case basis.

15. Acceptance Testing

15.1 Visual Inspection

The whole of the Works shall be visually examined for completeness and an acceptable standard of workmanship and finish. Visual examination will be either indirectly with the use of CCTV as or directly as appropriate for internal surfaces of pipelines and other parts respectively. Direct visual examination shall be undertaken with strong portable lighting.

15.2 Compaction Testing

15.2.1 General

Refer to Table 19.1 and associated notes in SEQ Water Code regarding minimum compaction of embedment, trench, embankments and other fills.

Test methods for determining the degree of compaction shall comply with the appropriate part of AS 1289.

(a) The Contractor (or the Designer for development works) shall be responsible for all compaction testing and shall arrange for the testing to be carried out by a NATA certified Test Laboratory. Modified compaction tests shall be used.

(b) Prior to commencing work the Contractor / Designer shall prepare test plan showing the number of tests and depths in each zone where tests are to be carried out.

(c) Unitywater shall randomly select test locations in each zone. The road authority supervisor may direct Unitywater's Laboratory to undertake additional tests in any zone. The test locations shall be uniformly distributed over the works.

(d) Testing shall not be clustered within a zone or at boundaries of a zone. In deep trenches where more than 1 layer is to be tested, the test locations shall, where practicable, be staggered from those layers above or below by at least 5 m for water mains.

(e) The compaction tests including retests shall be carried out at the Contractor's / Designer's cost until satisfactory compaction levels are achieved.

15.2.2 Embedment Compaction Testing

15.2.2.1 Applicable pipe sizes

Undertake compaction testing of pipeline embedment for trunk water mains > 300 mm NB.

Except where the Unitywater Superintendent nominates random confirmatory tests, do not undertake compaction testing of pipeline embedment for trunk mains ≤ 300 mm NB where:

(a) the allowable bearing pressure of the native soil is ≥ 50 kPa;

(b) pipe laying and embedment compaction was carried in accordance with this Code; and

(c) a pre-qualified compaction method was used in accordance with Clause 16.3.2.

15.2.2.2 Frequency and location of embedment tests

For trunk water mains > 300mm NB, test at the spring line (±100 mm) of a complete embedment zone for each 50 lineal metres of pipeline or part thereof.

15.2.2.3 Retesting

If one or more of the initial test results do not comply with SEQ Water Code Table 19.1, conduct two additional tests in the zone represented by the initial test. If anyone of the repeat tests does not comply, re-compact the full zone and continue repeat testing. Continue this cycle until the embedment compaction test results comply with SEQ Water Code Table 19.1.

15.2.3 Trench fill compaction testing

15.2.3.1 Trafficable Test Zone

For trenches located in trafficable area, assume the depth of trench to be the full depth of trench fill i.e. from the surface of the trench fill to the top of the pipe embedment.

Refer SEQ Code Standard Drawing SEQ-WAT-1200-2 for guidance regarding typical embedment and trench fill arrangements.

The Road Owner may specify additional compaction testing requirements.

15.2.3.2 Non-trafficable Test Zone

For trenches located in a non-trafficable area, assume the length of trench represented by a test to be 50 m either side of the location at which a test is made. Assume the depth of trench to be the full depth of fill.

15.2.3.3 Property Services

This clause does not apply to trunk water mains.

15.2.3.4 Retesting

If one or more of the initial test results do not comply with SEQ Water Code Table 19.1, conduct two additional tests in the zone represented by the initial test. If any of the repeat tests does not comply, re-compact the full zone and continue repeat testing. Continue this cycle until the trench fill compaction test results comply with SEQ Water Code Table 19.1.

15.2.4 Other Fill Compaction Testing

15.2.4.1 Frequency and Location of Tests

For compacted material located in a trafficable zone, conduct one test in each 300 mm of the depth of fill and each 300 m^2 of area or part thereof.

For compacted material located in a non-trafficable zone, conduct one test in each 900 mm of the depth of fill and each 1200 m^2 of area or part thereof.

Unitywater may at its discretion, direct the Contractor to undertake additional random confirmatory tests.

15.2.4.2 Retesting

For non-trafficable areas, if one or more of the initial test results do not comply with SEQ Water Code Table 19.1, conduct two additional tests in each of the areas of the relevant depth of fill represented by the initial failed test(s). If any of the additional tests do not comply, re-compact the represented compacted material zone and repeat the testing. Continue this cycle until the compaction test results comply.

For trafficable areas, if any test results do not comply with SEQ Water Code Table 19.1, re-compact the represented compacted material zone and repeat the testing.

15.3 Water Quality Testing

15.3.1 General

It is compulsory for all new mains to pass bacteriological tests. Contractors / Designers are responsible to arrange the tests.

Unitywater shall be consulted as to the maximum allowable period between a successful test being obtained and the connection of a new main to the water supply network, as retests will be required where this limit is exceeded. Contractors / Designers are responsible for the costs associated with water quality testing.

Contractors / Designers shall follow Pr9032 - Procedure for Managing Water Quality During Mains Commissioning which defines the process for commissioning potable water mains.

15.3.2 Test Procedure

Not used

15.3.3 Satisfactory Water Quality Test

Not used

15.4 Polyethylene Pipelines Installed Using HDD Techniques

An additional 3 m length of pipeline shall be butt-welded to the leading end of the pipe string prior to placement. After the pipeline has been pulled through sufficiently to expose the additional 3 m length, an Unitywater representative and the Contractor shall jointly examine it.

If the pipe length is significantly damaged, as defined below, complete replacement of the entire HDD pipeline shall be undertaken.

Significantly damage is defined as:

(a) Scratches deeper than 10% of the pipe wall thickness are evident.
(b) Any evidence of plastic failure of the pipe due to tensile forces (e.g. necking or reduction in outside circumference compared with the supplied pipe).

16. Disinfection

16.1 Application

Swabbing is not required by Unitywater under normal conditions as per Clause 18.1.

16.2 Flushing of Disinfection Water

The flushing of TWM shall be in accordance with Unitywater Pr9032 – Procedure for Managing Water Quality During Mains Commissioning and Water Services Association of Australia (WSAA) Guideline: Discharge of Chlorinated Water to Waterways, National Guidance for the Water Industry

No disinfection water shall be permitted to enter the reticulation system or be discharged to the storm water drains or waterways unless approved by the regulator i.e. DEWS.

Refer to Unitywater document Pr11074 - CIPM - Site Assessment Procedure that was completed as part of the Design Process for De-chlorination requirements.

17. Connections to Existing Water Mains

17.1 General

All works on the existing TWM system shall be considered as “live works” and will be controlled by the Unitywater or their delegates and shall be at the Contractor’s cost. The installation details shall comply with the details given in Clause 5.9.

18. Work As-Constructed Details

Prepare and submit asset as-constructed data and asset manuals to Unitywater in accordance with the SEQ D&C Asset Information Specification.

19. Standard Drawings

There is a list of Standard Trunk Water Main drawings in Appendix TWM-A. These Unitywater Example Project Drawings are not suitable for construction. The detailed design must be an RPEQ certified engineering design and consider the specific site/s and conditions of the project.

In the event that there is a discrepancy between the TWM Code text and the Example Drawings in Appendix TWM-A, the TWM Code text takes precedence.

*Refer to **Appendix TWM-A** for example project drawings that provide guidance regarding typical TWM arrangements and requirements.*

*Refer to **Appendix TWM-B** for a list of relevant SEQ Code Standard Drawings that may also be used for guidance when developing TWM designs.*

A. Appendices

Please find on following pages.

TWM – A - Example project Drawings

Below is a list of example project drawings which are **provided for guidance** only to show typical minimum requirements. Please note that these drawings are not suitable for construction without further engineering design detail. The below drawings are not to be referred to or referenced within Design Drawings and Documentation.

Table A1 – Example Project Drawings

Example Project Drawing Number	Example Project
UWDSTD-C-DR-7020-00 – 07 UWDSTD-C-DR-7020-14 - 16	Standard Drawings
UWDSTD-C-DR-7020-08 UWDSTD-C-DR-7020-09 UWDSTD-C-DR-7020-18 UWDSTD-C-DR-7020-19	Air Valve Pit Details
UWDSTD-C-DR-7020-10 UWDSTD-C-DR-7020-11 UWDSTD-C-DR-7020-22	Scour Valve Details
UWDSTD-C-DR-7020-12 – 13	Isolation Valve Details
UWDSTD-C-DR-7020-17 UWDSTD-C-DR-7020-20 UWDSTD-C-DR-7020-21	Flow Meter Details

NOTE: The drawings are in a separate document.

TWM – B - Relevant SEQ Code Standard Drawings

Below is a list of relevant SEQ Code Standard Drawings that may be used for guidance only when designing trunk water mains. Please note that the below drawings are generally not suitable for construction without further engineering design detail.

The current version of the below drawings can be obtained from the SEQ Code website at: http://www.seqcode.com.au/seq-water-supply-code/

Table B2 – Example Project Drawings

SEQ Code Standard Drawing Number	Drawing Title
SEQ-WAT-1103-1	Typical Mains Construction – Distribution and Transfer Main Arrangements
SEQ-WAT-1105-1	Typical Connection to Existing Mains – Sheet 1 of 2
SEQ-WAT-1105-2	Typical Connection to Existing Mains – Sheet 2 of 2
SEQ-WAT-1105-3	Typical Connection to Existing Steel Mains
SEQ-WAT-1200-2	Embedment and Trench fill – Typical Arrangement
SEQ-WAT-1201-1	Standard Embedment – Typical Flexible & Rigid Pipes
SEQ-WAT-1202-1	Typical Special Embedment – Inadequate Foundations Requiring Over Excavation & Replacement
SEQ-WAT-1203-1	Typical Special Embedment – Concrete & Stabilised Embedment and Flexible Joint Details
SEQ-WAT-1205-1	Typical Thrust Block Details – Mass Concrete
SEQ-WAT-1206-1	Typical Thrust and Anchor Blocks for Valves
SEQ-WAT-1208-1	Typical Restrained Joint System – DN100 to DN375 DI Mains
SEQ-WAT-1209-1	Typical Trench Drainage – Bulkheads and Trench stop
SEQ-WAT-1210-1	Typical Trench Drainage – Trench Systems
SEQ-WAT-1211-1	Typical Thrust Block Details – Under Obstructions
SEQ-WAT-1212-1	Typical Buried Crossings – Major Roadways
SEQ-WAT-1213-1	Typical Buried Crossings - Railways
SEQ-WAT-1214-1	Typical Buried Crossings – Bored and Jacked Encasing Pipe Details
SEQ-WAT-1300-1	Typical Valve, Hydrant and Water Main Road Crossing – Road and Pavement Markers
SEQ-WAT-1300-2	Typical Valve and Hydrant Identification Marker Posts
SEQ-WAT-1301-1	Typical Valve Installation – General Arrangements
SEQ-WAT-1305-1	Typical Surface Fitting Installation – Valve and Hydrant Surface Boxes – Trafficable and Non-trafficable
SEQ-WAT-1306-1	Typical Surface Fitting Installation – Valve and Hydrant Surface Boxes – Support and Surround Details
SEQ-WAT-1309-1	Typical Appurtenance Installation – Passive Pressure Reducing Valves (PRV)

TWM – C – Relevant Unitywater Documents

Below is a list of relevant Unitywater Documents relating to the design and construction of trunk water mains to be owned and operated by Unitywater.

Table C3 – Planning Documents

Document ID	Document Title	Document Type
Pr9660	Netserv Plan Part A	Public
	SEQ Code Design Criteria	Public
Pr11057	CIPM - Capital Infrastructure Project Manual	Internal

Table C4 – Development Services Documents

Document ID	Document Title	Document Type
Pr9660	Netserv Plan Part A	Public
Pr9855	Service Advice Notice (SAN) Procedure	Advice
F10716	Decision Notice Template	Advice

Table C5 – Risk Management Documents

Document ID	Document Title	Document Type
Pr9306	Risk Management Procedure	Available on Request
Pr8187	Safety in Design Procedure	
Pr10883	Safety in Design Guidelines	
F11016	UW HAZID Electronic Recording Template	
F11017	UW HAZOP Electronic Recording Template	
F11018	UW CHAZOP Electronic Recording Template	
F11019	UW CHAIR Electronic Recording Template	
F10682	Risk Register Template	

Table C6 – Water Quality Documents

Document ID	Document Title	Document Type
Pr10997	Drinking Water Quality Management Plan Risk Methodology Work Instruction (DWQMP)	Public
BP8137	Drinking Water Quality Policy	Public
	Appendix I of SEQ Water Supply D&C Code	Purchase

Table C7 – General Engineering Documents

Document ID	Document Title	Document Type
Pr8843	Specification for Drawings, Document and Equipment Tag Numbering	Public
Pr9080	Specification for CAD/BIM Drafting and Modelling Standards	Public

Table C8 – Civil & Structural Engineering Documents

Document ID	Document Title	Document Type
Pr9902	Specification for Civil and Earthworks	Public
Pr9769	Specification for Concrete Surface Protection	Public
Pr9904	Specification for Pressure Pipeline Construction	
Pr9087	Pressure Testing of Water Mains Work Instruction	
Pr9821	Specification for Reservoir Design and Construction	
Pr9788	Specification for Horizontal Directional Drilling	
Pr9787	Specification for Microtunnelling and Pipejacking	
Pr9789	Specification for Augur Boring	
Pr9790	Specification for Pipe Ramming	
	CHECKLISTS, SCHEDULES & DATA SHEETS	
Pr8843	Specification for Drawings, Document and Equipment Tag Numbering	
Pr9903	Specification for Building and Structural Works	
Pr10360	Project Information Requirements	
F8614	Project Design Brief	
Pr8701	Specification for Asset Information	
Pr11211	Specification for Commissioning of Active and Passive Assets	
Pr9032	Procedure for Managing Water Quality during Mains Commissioning	

Table C9 – Mechanical Engineering Documents

Document ID	Document Title	Document Type
Pr9693	Specifications for Mechanical Installations	Public
Pr10932	Mechanical and Electrical Major Service Manual	Public

Table C10 – Electrical Engineering Documents

Document ID	Document Title	Document Type
F10678	Preferred Equipment List (Electrical and Instrumentation)	
	CHECKLISTS, SCHEDULES & DATA SHEETS	
F10678	Accepted Electrical Equipment List	
Pr9380	Specification for Electrical Installations at Network Sites	
Pr9743	Electrical Safety Procedure	
Pr8991	Performing Electrical Work Under a Restricted Electrical Licence	
SWMS9386	Work On or Near Energised Electrical Installations or Services Safe Work Method Statement	
Pr8780	Delivery of Planned Capital Works Electrical Projects Procedure	
Pr10618	Specification for Power Systems Analysis and Arc Flash Studies	

Table C11 – Control System Documents

Document ID	Document Title	Document Type
Pr8320	Change Management Procedure	Available on Request
Pr9834	Specification for SCADA Standard	
Pr9845	SCADA and PLC Implementation Specification	

Table C12 – Environment Requirements Documents

Document ID	Document Title	Document Type
Pr8196	Safety, Health and Environment Consultation and Communication Procedure	Available on Request
Pr8856	Project Control Environmental Procedure	

TWM – D – Relevant Code and Industry Documents

Below is a list of relevant SEQ Code. WSAA and PIPA documents relating to the design and construction of trunk water mains to be owned and operated by Unitywater.

SEQ Code Documents

To purchase a copy of the SEQ Service Providers Edition of the Water Supply Code of Australia, refer to https://www.wsaa.asn.au/shop

For more details regarding the SEQ Water Supply and Sewerage Design and Construction Code, refer to: www.seqcode.com.au.

Table D13 – Relevant SEQ Code Documents

Document Title	Document Type
SEQ Service Providers Edition of the WSAA Water Supply Code, Version 1.3 (August 2019)	For Purchase
SEQ Code Standard Drawings	Public
SEQ Code Water Supply and Sewerage Design Criteria	Public
SEQ Accepted Civil Infrastructure Products & Materials List	Public
SEQ Accepted Mechanical Products & Materials List	Public
SEQ Code Asset Information Specification	Public
SEQ Code Design Criteria	

WSAA Documents

To purchase relevant WSAA Code, refer to: https://www.wsaa.asn.au/shop

To obtain the latest version of the WSAA Product Specifications, refer to: https://www.wsaa.asn.au/shop/category/11

Table D14 – Relevant WSAA Documents

Document Title	Document Type
SEQ Service Providers Edition of the WSAA Water Supply Code, Version 1.3	For Purchase
WSA 03-2011 Water Supply Code of Australia, Version 3.1	For Purchase
WSA 01-2004 Polyethylene Pipeline Code, Version 3.1	For Purchase
WSAA Product Specifications	Public

PIPA Guideline Documents

To obtain the latest PIPA Technical Guidelines, refer to: https://pipa.com.au/technical/pop-guidelines/

Table D15 – Relevant Plastics Industry Pipe Association of Australia (PIPA) Technical Guideline Documents

Document ID	Document Title	Document Type
POP001	Electrofusion Jointing of PE Pipe and Fittings for Pressure Applications	Public
POP003	Butt Fusion Jointing of PE Pipes and Fittings – Recommended Parameters	
POP004	Packaging, Handling and Storage of Polyethylene Pipes and Fittings	
POP004A	Supplementary List – Materials Specific to Electrofusion and Moulded Fittings	
POP005	Packaging, Handling and Storage of Polyethylene Pipes and Fittings	
POP006	Derating Requirements for Fittings	
POP007	Metal Backing Flanges for Use with Polyethylene (PE) Pipe Flange Adaptors	
POP010A	Part 1: Polyethylene Pressure Pipes Design for Dynamic Stresses	
POP010B	Part 2: Fusion Fittings for Use with Polyethylene Pressure Pipes Design for Dynamic Stresses	
POP013	Temperature Rerating of PE Pipes	
POP014	Assessment of Polyethylene Welds	
POP018	Polyethylene Drinking Water Pipes in Contact with Chlorine and Chloramine Disinfectants	
POP202	PVC, PP and PE Pipe Installation on Curved Alignments	